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By Felix Edgar Wormser

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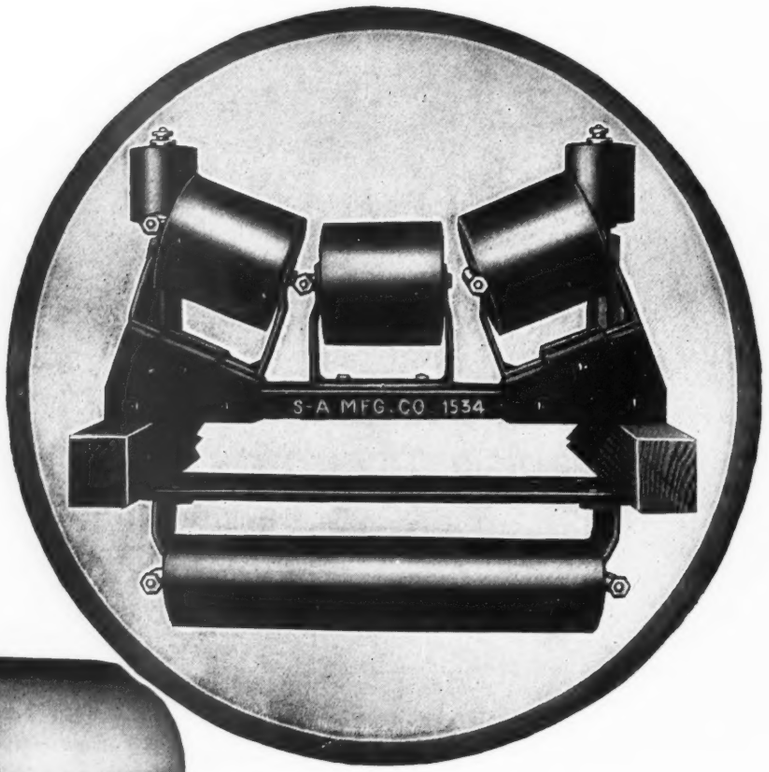

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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 118 New York, July 26, 1924 *Number* 4

Compensation of Engineers

WHEN the small compensation of engineers, technologists, and men of science attracts the editorial notice of the *Saturday Evening Post* we may well believe that we of the guild have not been mistaken as to the situation. That interesting journal observes that whereas a few years ago the college professor was at the bottom of the economic heap, with the lowest rate of compensation, he has since bettered his position, while the engineer and man of science has succeeded to the unenviable distinction of being the poorest paid. Specialists of high attainments in Washington, the *Post* observes, are paid wages which a self-respecting plasterer would decline.

The *Post* exaggerates when it states that the pay of engineers puts them at the bottom of the scale; but it is a fact that the engineer's pay is less than it should be. This statement applies perhaps more to the electrical and mechanical engineers than to the mining engineers: but comes too close to the last named to be comfortable. The remedy will be in the ultimate scarcity of material which will result: in the revolt of the engineer, the scientist, and the technologist, and his determination to turn to business or even to the work of his hands rather than suffer further unfavorable comparison because he has sacrificed years to mental and professional training. Those who pay will pay more if they have to and when they have to: and not before. Signs of this are not absent, even now. The Department of Commerce, for example, has had to pay more for some of its division chiefs than would have been necessary a few years ago.

The art of selling himself is one that the engineer must learn. This is an age of putting one's best foot foremost, and demonstrating what he can do, before a critical and pessimistic audience of employers. Engineers are psychologically poor collectors: they suffer from an excess not of modesty but of shyness, and a lack of training in bargaining: and that is a handicap when they meet up with the man of capital. This indispensable personage holds cheaply the man he can hire cheaply.

Tube-mill Grinding Media

RECENTLY WE PUBLISHED an article in our department devoted to new machinery and inventions, calling attention to the experimental use of cubes instead of balls in the tube mills of a Phelps Dodge subsidiary, the Moctezuma Copper Co., at Nacozari, Mexico. Two letters in our discussion section this week refer to the same matter, and many millmen are interested. It may be well to point out that the idea of using steel cubes instead of steel balls is not entirely new, for these media were given a try-out by some of the Jackling mills several years ago, notably at the Hayden concentrator of the Ray Consolidated, but we do not believe that they have ever been given the thorough test that they are now undergoing at Nacozari. The records are not yet sufficiently complete to enable one to form an opinion as to when cubes should displace balls, if at all; as soon as some definite information is obtained at Nacozari—when the mills using cubes have operated for a sufficient length of time at full capacity—we expect to publish the results. In the meantime, those who wish to use the cubes should do so with the full understanding that their relative advantages are as yet unproved on a large scale.

The idea of a surface contact instead of a point contact, as with balls, or a line contact, as with rods, is attractive, as Mr. Rose says. And Mr. Del Mar's suggestion that hexagons would be even better than cubes is also worth a trial. Further, as no one has mentioned it yet so far as we know, may we suggest the use of rectangular or hexagonal rods instead of the round ones now used in a rod mill.

Exchanging Engineering Knowledge

A YOUNG MINING ENGINEER recently told us of an interesting and suggestive experience he had had while visiting, during his undergraduate days, one of the smelters of the Southwest. A foreman with whom he was conversing reproached him for asking for certain details about the operation of the smelter, with this complaint: "You fellows come down here, get all the information you can, information it has taken us years to acquire, and give nothing in return. And afterward you compete with us." These remarks probably express a feeling that is not confined to the smelter foreman in question. More than likely the thought is dormant in the minds of others. Although it is too much to expect to alter this short-sighted attitude, reflection will show its false philosophy. Engineering progress requires absolute freedom in the exchange of technical views, and full instruction of those who want to carry the work forward. The smelter foreman was taught by someone; he did not acquire all his knowledge unassisted. With further application and study he has nothing to fear from competition from anybody.

We have never heard of a company or person being injured by a free interchange of technical opinion. An extraordinary example of frankness in revealing technical details is that of the Ford organization. Henry Ford is generally conceded to have one of the most efficient, if not the most efficient, industrial machines in the world. His production methods in many respects, have been revolutionary and the result of patient and costly investigation and experiment. The Ford plant is open to anyone wishing to study Ford practice. No attempt has been made to hide from competitors or other interested parties the methods pursued. Those who wish to profit from the results of Ford technical achievements are not hampered by any restrictions as to their use. And yet the Ford plant has become one of the greatest industrial enterprises of the age, and an exceedingly profitable one.

A somewhat different example, but one illustrating the benefit of an exchange of technical information, occurred a few months ago, while a prominent Swedish metallurgical engineer was visiting the United States. This engineer was particularly anxious to observe the practice of brass and copper mills in Connecticut. Some of these establishments are not very keen about having visitors pass through them, and it was only after the kindly efforts of a friend in the company whose plants he wished to inspect that the Swedish engineer secured the desired permission. At that time the brass company was having trouble with electric-furnace operation and it so happened that the foreign engineer had long experimented with electric melting. In fact, he was able to make some suggestions during his stay at the plant which proved eminently practicable and solved a difficult problem for the company, saving it many hours of labor and an expenditure of considerable money. The visiting engineer was also able to learn at first hand the local practice—a fair exchange so far as both parties were concerned—and an excellent illustration of mutual benefit from technical co-operation.

Marine and Mining Engineering

IT IS WITH SURPRISE that we note Bulletin No. 214 of the U. S. Bureau of Mines, on "Tests of Marine Boilers" (302 pages, 165 figures). The first reaction is to rub one's eyes and verify the fact; the second is to question why the Bureau of Mines should publish a bulletin on marine boilers. And this, for the reader who belongs to the mines group and is accustomed to the Bureau of Mines publications, outweighs other elements of interest to the end. It is a fairly safe statement that only a few of those who are on the mailing list of the Bureau have any curiosity concerning marine boilers. It is also true that the multitude who are interested in marine boilers will never look for articles on the subject among the publications of the Bureau of Mines, and that whatever wisdom and technical advancement is contained in this volume is about as inaccessible to those who would profit by it as if it were still in the author's manuscript.

The puzzle as to the why of the publication is solved in the preface. During the World War, the Emergency Fleet Corporation, a government organization, embarked on a scheme to build wooden ships on a standardized pattern, and in great numbers. Among the parts of the ships' equipment that were to be standardized were the boilers, which were to be built wholesale on the seacoast, where the ships, whose parts were to be manufactured at many points, were to be assembled, as is done with automobiles. The first boilers built under this plan were tested by the fuel section of the Bureau of Mines, directed by the engineer of the Emergency Fleet Corporation. These tests were continued after the war. They comprise tests for combustion; heat absorption by boilers; the flow of gases; insulation of the furnace walls; the circulation of water; the effect on heat transmission of blowing soot off the heating surfaces with steam blowers; and the use of special equipment to improve combustion or heat absorption.

This is plainly a problem in mechanical, or, more specifically, marine engineering. The plan to build hosts of wooden ships, as is well known, was signally unsuccessful and expensive. We suspect that among the last items of this expense is the publication of this bulletin, which is so grotesquely out of place among the technical publications of the U. S. Bureau of Mines.

Foremost of the names on the title page we note that of the well-known great economizer in government outlays—that distinguished engineer and administrator —Secretary Hubert Work. We suggest that Secretary Work appoint a special commissioner, at an adequate salary, to report on what is the difference, if any, between mining engineering, marine engineering, hydraulic engineering, and railroad engineering; also, under the auspices of what governmental bureau it would be most appropriate to publish Shelley's "Ode to a Skylark."

Copper and Electricity to Vanish in Twenty Years?

LAST WEEK we reprinted part of an address made by Ira B. Joralemon before the Commonwealth Club of California, in which he stated that "the age of electricity and of copper will be short. At the intense rate of production that must come, the copper supply of the world will last hardly a score of years. . . . Our civilization based on electrical power will dwindle and die." We are rather surprised that a geologist of Mr. Joralemon's standing cannot use his imagination a little more than this, but no doubt he was painting the picture as black as possible so that copper miners would wake up to the fact that they are rapidly wasting a valuable natural resource with little or no profit to themselves. Known deposits of copper ores of a present commercial grade are limited, as Mr. Joralemon says, and it might be possible that in twenty years electrical requirements will have milked most of them dry. But metallurgical methods will advance; likewise prices, we hope; so that it will pay to mine lower grade deposits of which there is a tremendous tonnage available, and also deeper deposits such as our friends in Michigan have. And we can hardly believe that all the copper resources of the world are known. Twenty years ago, for example, who would have classed such deposits as those at Chuquicamata and Bingham Canyon as important factors, even with the price of copper somewhat higher than it is now?

As to the electrical industry, we can hardly believe that all our electricity will go back into the clouds where Franklin found it, just because copper is scarce. Maybe copper won't be required at all for transmission purposes; we may just use the ether.

A Myriad of Patents

ONE AND A HALF MILLION patents issued at Washington up to July 1! Fifteen hundred thousand new or supposedly new ideas, for which inventors have sought protection! To set them forth in their proper order would be to chronicle the industrial progress of the world during the last eighty-eight years —since 1836, when the first patent was granted. What a vast amount of human triumph and endeavor these figures represent! What fortunes amassed, what distinction earned, what blasted hopes they stand for! And what an awesome amount of litigation—enough to make a lawyer's heart beat high! The genius of invention that they demonstrate has too often been outwitted by a genius for appropriating other folks' ideas. The patent once granted must be defended against infringement at one's own expense. Protection must be fought for, and is not given with the patent.

And what a lot of nonsense the *Gazette* at times con-

tains! More in jest than earnest it occasionally seems that patents have been granted. A doll's toothpick, a crane for lifting oneself by one's boot straps, a hoist for hoisting with one's own petard! These or others equally clever are sometimes found within its covers. These, however, serve merely to make lightsome reading and to enhance by contrast the brilliance of the ideas of great inventors.

Future Supply of Diamonds

A PROMINENT DIAMOND IMPORTER and merchant reminds us that the development of diamondiferous areas is not keeping pace with production and consumption; he states that in 100 years the present reserves will be exhausted. We recall the optimism of the chairman of De Beers, who believed in the future of the industry "so long as men are foolish and women are vain"—a state of affairs that seems unlikely to change with the passage of time.

The stability of the diamond market is, of course, due largely to a sensible control of production; and although output has been restricted, it is evident that future discoveries will be needed to keep pace with requirements. The metal miner is free from competition on the part of those who manufacture synthetic products; he deals with elements, not compounds. But the diamond miner is faced with the possibility of artificial production by intense heat and pressure, thus duplicating the methods adopted in Nature's workshop. Science has proved that artificial diamonds can be made, but the cost of production by known procedure is far in excess of the amount needed to purchase in the open market. Furthermore, with gem stones, value increases out of proportion to size; consequently, seed diamonds produced artificially would fetch a low price. This has deflected attention from research; but it is evident that diminishing supply and mounting prices would stimulate inventiveness, which might well lead to comparatively cheap production. It behooves the diamond miner, therefore, to remember that the monopoly of even so rare and coveted a product may be short lived, and to make every effort to regulate supply to demand so long as a fair price is obtainable.

Fugitive Oil Promoters

THE GET-RICH-QUICK swindlers that were operating in Texas and elsewhere in the Southwest until the Federal Government stepped in and sent Dr. Cook and S. E. J. Cox to jail have indeed moved across into Mexico, as had seemed to be the case. According to the *New York Times* of July 11, it turns out that some of these gentry who were under indictment in Texas jumped their bail and fled across the border with others against whom the government had not yet taken action. Through the American Embassy in Mexico City, the Post Office and the departments of Justice and State are seeking to have these fugitives arrested. There are difficulties in the way of apprehending the others, however, as it is virtually impossible under the Mexican law to take action against them until complaints have been received from Mexican citizens.

It is not likely that these crooks will give Mexican citizens ground for complaint, for the whole expanse of the great United States stretching north of the Rio Grande offers a field sufficiently wide and fertile to repay them for any efforts they may make from the Mexican side of the line. Why, then, run counter to the Mexican law? Just how the problem of stopping this nefarious work will be solved may take an international lawyer to decide. There are times when horse sense dictates that fine points of the law be ignored.

An Embarrassment of Riches

THE DISCOVERY of a rich field of sapphires in the Anakie district, in Queensland, Australia, and of a similar field in the Pelmadulla region in Ceylon, the latter find just announced, has not proved profitable to the miners and prospectors through whose efforts the discoveries were made. In fact, they find the situation vexatious. Their position is analagous to that of some of the ancients—the Incas, for example—with whom gold was held in less esteem than some other metals that could be manufactured into objects of greater utility.

The Ceylon and Australian producers of sapphires find no one at hand ready to buy their gems. In Ceylon, dealers have not enough money with which to purchase the unexpected quantity of jewels brought to their counters. In Queensland the government has advanced £30,000 to the miners, and the Minister of Mines is doing everything possible to protect their interests; but the price offered by European dealers is unsatisfactory.

The old law of supply and demand seems to operate harshly for these miners of sapphires, as, indeed, it is doing even with the base-metal producers of the United States. Unless some such measure of control as protects the diamond market is created, sapphires may become as unacceptable to a fickle public as gold in modern wedding rings.

Another Doodle Bug

W. H. JEFFERY, "E. M.," of Haileybury, Ont., states in a circular letter that for over a year he has been trying out Mr. A. B. Cullen's mineral finder on gold and silver in developed and undeveloped mineral fields, and that in each trial the explorations were 100 per cent satisfactory. Perhaps he means that the device indicated nothing and that nothing was likewise found. But no, Mr. Jeffery proceeds to explain the principle on which the instrument is designed. "All materials of mineral origin seem to give off emanations different for each element," he says. "The difference probably lies in the speed of the electrons given off and has some certain relation to the atomic weight of the elements." These variations, he says, permit Mr. Cullen to differentiate clearly between "the various materials forming a deposit, by synchronization of the apparatus to waves of different form." The apparatus can be adjusted for "practically all useful materials found in the earth."

All this is jargon, the juggling of a few high-sounding words that for the moment make buncombe seem like sense. When Mr. Mills wrote his interesting book "Within the Atom" and discussed the theories of atomic structure and energy in such simple language that almost any intelligent person can, by study, get some idea of what they are, he put a new language into the mouths of these pseudo-scientists. The fashion changes in fake prospectuses, as in other things, and today they prate of emanations, electrons, and atomic weights, and make astounding claims far in advance of what has yet been achieved in laboratories as a result of painstaking research.

Progress in Leaching the Ohio Copper Mine

Production Has Been Increased with Larger Pumping Equipment—Costs Lowered

By Felix Edgar Wormser
Assistant Editor

WHEN the Ohio Copper Co. began leaching its copper mine on a commercial scale, in January, 1923, the first month's production was 88,100 lb. For June, 1924, production amounted to more than 1,200,000 lb. of copper, which was recovered at the very low operating cost of 5.31c. per lb. The expectations of the company that it would be able to treble its output of 300,000 lb. monthly in 1923—the maximum possible with the equipment on hand—by installing a larger pumping plant, have been more than fulfilled, as shown by the complete record on page 125.

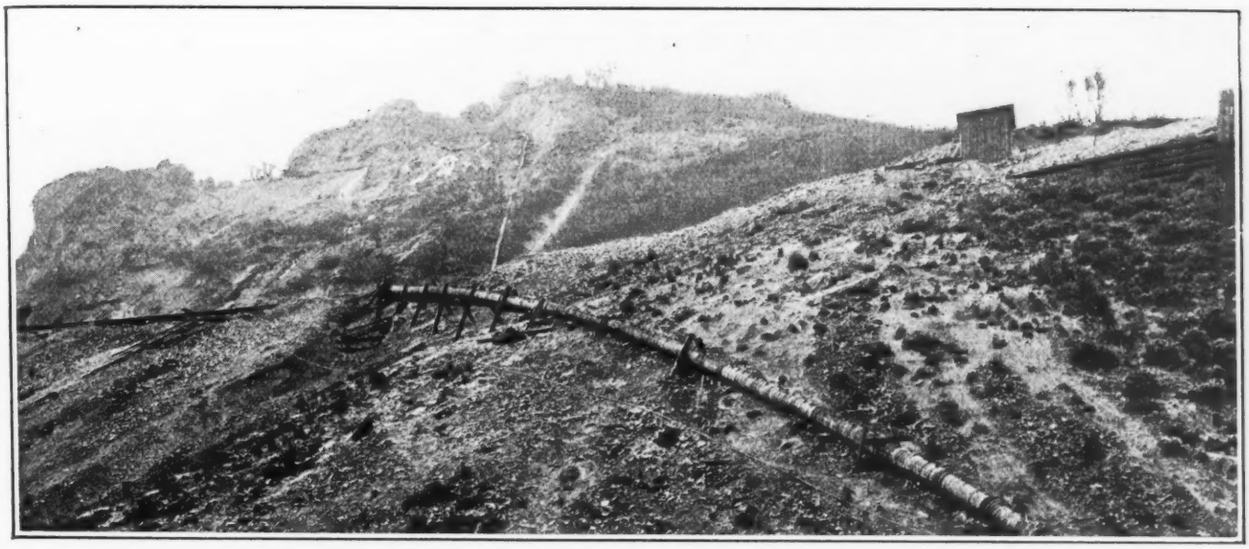
The novel operations of leaching in place and the first experimental work were described in an earlier article.[1] This article is merely intended to chronicle the progress that has been made since that paper appeared.

[1]"Leaching a Copper Mine," *E. & M. J.-P.*, Oct. 20, 1923.

Briefly reviewing, the Ohio mine is a low-grade copper deposit on the east side of Bingham Canyon directly opposite the property of the Utah Copper Co. The caved area of the mine contains, it is estimated, about 38,000,000 tons of 0.3 per cent ore, or 6 lb. per ton—228,000,000 lb. of copper. This would ordinarily be classed as waste material. The mine was unsuccessfully worked by a block-caving method down to the 750 level, owing to the low tenor of the ore and the fact that the ore oxidized rapidly when once broken, making it unsuited to usual methods of concentration. A unique scheme of leaching the broken-up stopes and adjacent caved area of the mine was then tried and has turned the mine into an active low-cost producer asking no quarter from any competitor. Ordinary untreated creek and mine drainage water is poured over the surface of the caved part of the mine, allowed

East Fork of Bingham Canyon. Caved surface of Ohio Copper Co. in foreground. Utah Copper operations in background

Note the long launder resting on an embankment on the Ohio property. This carries the leaching solution. At the time this photograph was taken the solution was discharged near a spot indicated by the puddle in the right foreground. Ohio's main shaft is on the other side of the promontory on the left of the photograph, and cannot be seen from this point.



The long redwood pipe line carrying the solution over the surface

In the background the solution is being discharged and is cascading over a caved area at a point about 1,000 ft. distant from that shown in the photograph of Bingham Canyon.

to percolate through the mine workings, and caught in precipitation boxes 1,100 ft. below. There the copper is precipitated upon detinned scrap-iron. The entire method is extremely simple.

The new pumping plant consists of a series of four Allis-Chalmers acid-resisting centrifugal pumps situated on the 100, 400, 750, and Mascotte tunnel levels. They are all single-stage units with a capacity of 1,500 gal. per minute and are electrically driven. These pumps lift the mine drainage water and some of the solution after it has passed through the precipitation boxes by easy stages through the mine shaft to the surface, where it is distributed over selected spots. The new 10-in. pipe line used is made of redwood by the Redwood Manufacturers Co. and is copper-bound,

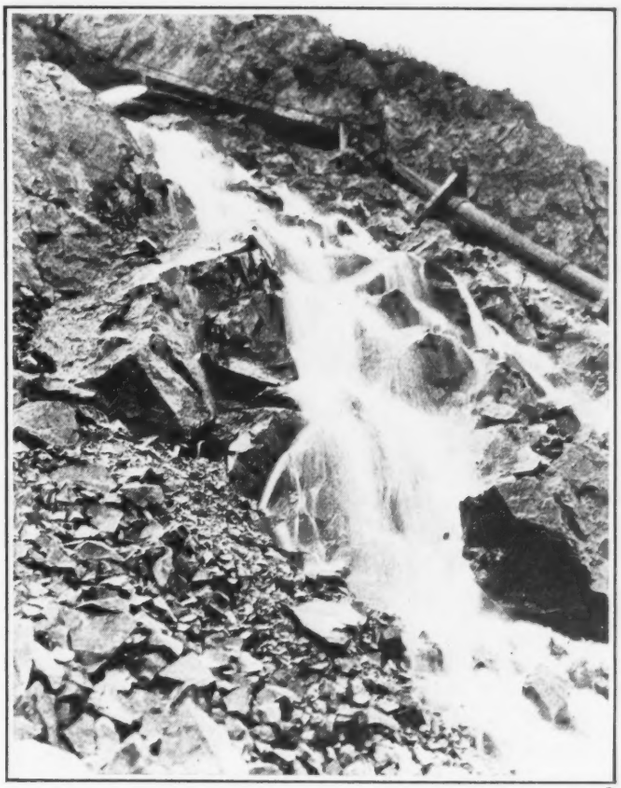
Monthly Production, Operating Cost, and Profit

1923	Production, Net Lb.	Sales Price, Cents Per Lb.	Cost, Cents Per Lb.	Profit, Cents Per Lb.	Operating Profits
January.....	88,097	14.625	9.03	5.595	$4,927.46
February.....	155,934	16.375	7.32	9.052	14,115.14
March.....	238,304	16.736	7.149	9.587	23,347.55
April.....	156,701	16.0625	8.752	7.31	11,454.52
May.....	257,613	14.578	7.175	7.403	19,048.78
June.....	332,786	14.263	6.444	7.819	26,021.30
July.....	331,153	14.2166	6.152	8.0646	26,703.13
August.....	283,933	13.526	6.962	6.564	18,637.19
September....	326,286	13.261	6.451	6.81	22,219.97
October.....	322,414	12.2789	6.6553	5.6236	18,130.92
November....	644,285	12.61	6.64	5.97	38,466.06
December....	681,911	12.691	6.678	6.013	41,008.85
Summary...	3,819,417	13.735	6.82	6.915	$264,080.87
1924					
January.....	846,665	12.2203	5.964	6.2554	$52,962.50
February.....	725,307	12.6192	6.2857	6.3605	45,937.02
March.....	847,858	13.3911	5.8616	7.5295	63,839.82
April.....	864,567	13.1595	5.6139	7.5456	65,236.63
May.....	1,080,763	12.6781	5.5542	7.1239	76,990.83
June.....	1,222,131	12.2695	5.3143	6.9552	85,001.33
Totals.....	5,587,291	12.6944	5.715	6.9794	$389,968.13

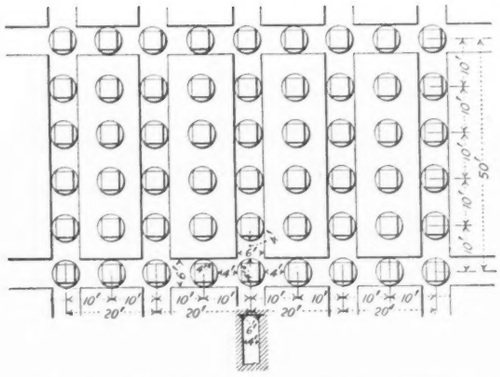
owing to the slightly acid solution handled.

Although the company originally intended to use a large part of the leaching solutions over and over again, it soon discovered that this plan was not so effective as using a large proportion of fresh water. Furthermore, aërating the water before allowing it to percolate through the mine workings caused the solutions to become better leaching agents, owing to an increase of the dissolved oxygen in the water. Hence the solution now used contains an admixture of fresh water from the Mascotte tunnel and the creek in Bingham Canyon. The creek water is obtained under an agreement with the town of Bingham which is advantageous to both parties. Aëration of the water is now being accomplished by permitting it to cascade over part of the caved surface, as shown in one of the accompanying photographs.

Little, if any, leaching solution is lost by dissipation in the footwall—which is to be expected in view of the firm character of the quartzite and the plan on which early mine development was laid out. It is difficult to



How the leaching solution is aërated. It is frequently allowed to cascade over the surface before disappearing to do its work

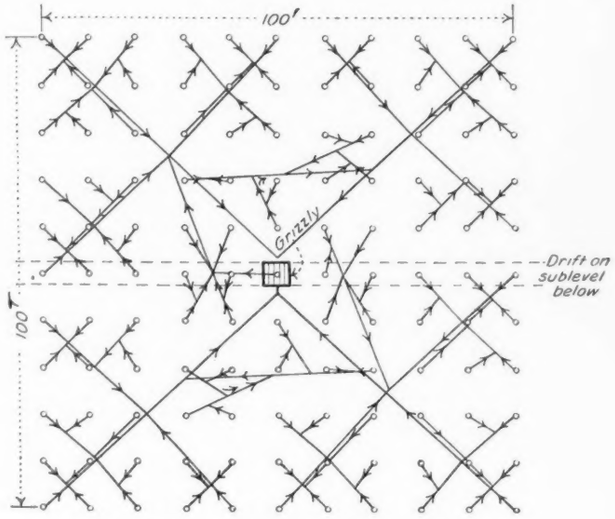


Plan of part of a block to be caved. Collars of the branch raises and the pillars between them are shown

overemphasize the part played by the mining method used when the Ohio Copper was worked by a form of block-caving. The present success of the leaching operation is largely based upon the mining method originally adopted. If leaching had been decided upon at the start to work the deposit, instead of mining and milling by usual methods, no better preparation could have been given the mine for the present operations. The company is already considering the advisability of caving additional sections of the mine to allow time for the elements to cause oxidation and thus prepare them for future leaching.

Four sketches accompanying this paper show the development of the mine at the time of active underground mining. Initially, the deposit was opened by a 50-deg. inclined shaft used only for men and tools and driven in the footwall. The ore itself was handled by gravity in chutes running parallel with the shaft and leading to ore bins over the tunnel, whence it was trammed two miles through the Mascotte tunnel to the mill at a place called Lark. Levels 60 ft. apart cut the lode and were divided into blocks 100 ft. square. Each block was undermined by a series of drifts, crosscuts, and raises in the following manner: Beginning at a central point on a sublevel 60 ft. below the block to be caved, four inclined raises were driven to the corners of the block. From the end of these raises, drifts or crosscuts were started along the edges of the block. At the same time other raises were driven as branches from the four main raises. From these, in turn, other shorter raises were driven to the lower surface of the block. Finally a treelike but regular arrangement of raises tapped the lower side of the block, leaving it supported by a checkerboard of pillars.

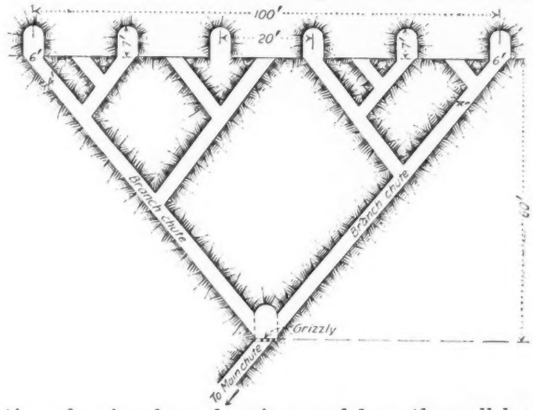
Collars of all the raises were 10 ft. apart. The last



Plan of a block 100 ft. square

This shows the course of the ore in the numerous raises driven preliminary to caving. All raises lead finally to one raise of the main ore chute. They furnish an ideal means for gathering the percolating leaching solution and sending it to the tunnel level.

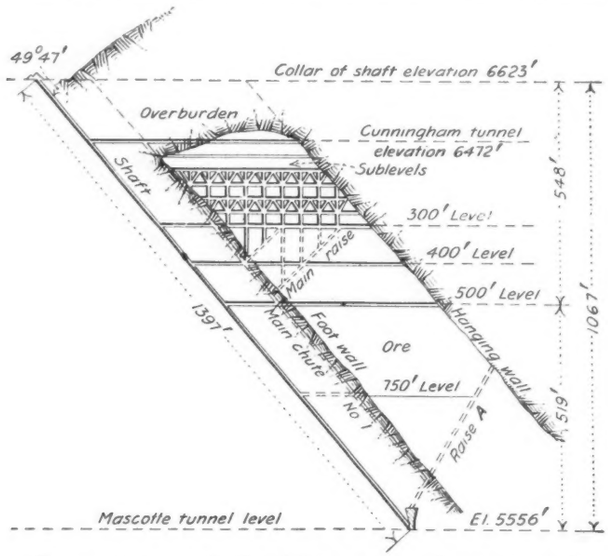
step was to drill all the supporting pillars, firing all holes simultaneously, and causing the whole block to cave with the aid of the heavy overburden. The accompanying diagrams make the method used clear. Of special interest is the plan showing the collars of the raises and the flow of the ore into and through them. The location of these raises and the path which the caved ore had to follow to reach the main ore chute furnish an excellent means of egress for the solutions



Section showing branch raises and how they all lead to one main ore chute

which now percolate through the caved stopes. The whole system may be likened to an artery with numerous regularly placed channels feeding it.

It is a question, of course, how much of the copper contained in the ore is actually leached. This depends on several factors, chiefly the size of the lumps in the caved areas and the degree of oxidation of the copper minerals in the ore. Naturally, roughly broken ore is not in a form ideal for leaching. Compared with



Cross-section of the Ohio mine, showing early development for block caving

Precipitation boxes along the Mascotte Tunnel

Detinned scrap iron from can factories is the precipitating agent used. Redwood pipe conveys the barren solution after precipitation back to the main shaft, where it is pumped to the surface. There are 3,200 ft. of precipitation boxes along the tunnel level.

the leaching of copper ores ground and sized on the surface, the method appears inefficient. Yet the efficiency of the Ohio Copper operations cannot be judged wholly by the amount of copper removed compared with that remaining in the ore. The cost of producing copper by present leaching methods in its relation to the price of copper compared with the much higher cost of making a more perfect extraction by other methods determines the economy of the method.

The management has not attempted to use sulphuric acid to increase the dissolving power of the solution and to raise extraction—a future expedient.

During the last year the solution has been directed to percolate over different parts of the caved surface. This was done to learn if the solution behaved satisfactorily so far as extraction is concerned in various parts of the mine. Another object was to find out if any channeling of solution or a tendency of all of it to follow a common course was noticeable. In one case the solution was allowed to percolate over the caved surface at two points separated approximately 1,000 ft. The solutions from both locations emerged at the ore bins in the Mascotte tunnel as all other solutions had heretofor. Two of the photographs show the points used. Additional experimentation with slight movements of the discharge pipe or launder were made at several points, and, as discovered last year, even so small a shift as ten feet retarded the flow of the solution in the precipitation boxes for many hours, and when the solution finally emerged its copper content was richer than before the change in position of the discharge pipe. If any channeling occurs it is probably negligible.

Detinned scrap from the Pacific Coast is still used as a precipitant and has proved eminently satisfactory. The cement copper produced is a high-grade material, as the following analysis of a typical sample shows:

Analysis of Ohio Cement Copper

	Per Cent
Moisture and combined water	0.97
Insoluble matter	0.84
Copper	89.78
Iron	1.68
Tin	0.36
Arsenic	0.030
Antimony	0.004
Bismuth	Trace
Lead	Trace
Nickel and cobalt	0.008
Zinc	0.024
Sulphur	0.19
Chlorine	0.037
Selenium and tellurium	None
Silver per ton of 2,000 lb., oz.	0.40
Gold per ton of 2,000 lb., oz.	0.055

Note—The sample contains no other metallic impurities. The matter unaccounted for is principally oxygen combined with sulphur, iron, and copper.

Analysis of Ohio Casting Copper

	Per Cent
Copper, (including silver)	99.615
Oxygen	0.261
Occluded gases	0.003
Sulphur	0.018
Lead	0.013
Bismuth	0.003
Arsenic	0.019
Antimony	0.002
Tin	0.030
Iron	0.016
Nickel and cobalt	0.004
Selenium and tellurium	None

The unusually high grade of the cement copper produced is due largely to the use of detinned scrap and allowing the solutions time to clear by settling before being directed through the precipitation plant.

Although the Ohio Copper Co. is shipping its cement copper to the Garfield smelter, experiments have been made with a view to producing casting copper at the plant. A sample of the experimental product turned out has the analysis shown.

Should a direct market develop for the cement copper produced or should the company convert its product into casting copper, it would seem possible that even the very low present cost of production might be bettered.

Power Economy in Elevating Ore Pulps

Care in Selecting Equipment, and Increasing the Ratio of Solids to Water, Result in Pronounced Operating Savings

By C. W. Tandy

ECONOMY OF POWER is not usually given the attention that it should have in the consideration of various devices and methods for elevating ore pulps. In making calculations, millmen consider the variation in power due to the difference in elevation between the intake and delivery points, but in the selection of the elevating device, made for the most part with regard to adaptability, first cost, and upkeep, little consideration is given to the efficiencies of the device and its prime mover. Furthermore, often no consideration is given to the nature of the pulp, aside from the possibility of its being abrasive or corrosive. The specific gravity of the pulp is entirely overlooked. No account is usually taken of the savings in power that may be effected by the elevation of less water, an oversight that has cost mining companies tens of thousands of dollars yearly. Of course, other factors may overshadow power economy.

To emphasize the foregoing it may be well to cite the installation that first forcibly directed my attention to the matter. This occurred in the early fall of 1922 during the reconstruction of the mill of the Nevada Consolidated Copper Co., at McGill, Nev., which was totally destroyed by fire during the summer of that year. The problem presented was to elevate ore received from the fine-ore bins to screens prior to tabling the undersize and tube-milling the oversize.

Four plans of elevating were considered: First by an inclined belt conveyor, adding water at the head end; second, by a bucket elevator, adding water in the elevator boot; third, by pumping with a centrifugal sand pump; fourth, by means of an air lift. The first method was rejected because of interference with the tube-mill crane aisle and the excessive inclination necessary. The low power consumption of the plan received no consideration. From a historical point of view the inclined belt conveyor received much consideration, as it was part of the old "Jackling flow sheet." The second scheme was rejected because of the high maintenance charges, the lack of floor space, and the difficulties of delivering ore to the elevator boot. Again the economy in power received no thought. The designer, following approved practice, planned an elevator with excess capacity and power to take care of an overload. The third scheme was promptly dismissed owing to the large size of the solids to be handled, and the excessive cost of repairs. The fourth plan, air-lifting of the pulp, was adopted because of its small floor area, its low maintenance charges, and its continuity of operation. So far as power consumption was concerned, the worst selection of all was made, because of the known low over-all efficiency of an air lift compared with the other devices, and the high cost of power at McGill.

Needless to say, the proposal to adopt an air lift met violent opposition. In addition to its low efficiency and the high cost of the accessory compressor plant, it was pointed out that precedent was wanting: although the Chino Copper Co. had handled by an air lift a tailing of 11 per cent solids, there was no certainty that an air lift would handle a pulp of 30 to 40 per cent solids, these limits being fixed by the minimum percentage of solids allowable in the flotation cells, and the maximum percentage of solids allowable on the tables.

When the first estimate of the power requirements for a 30 per cent pulp was compared with the power requirements of an inclined belt conveyor installed prior to the fire, it was noted that the power required for the air lift was several times greater than that required for the inclined belt conveyor. Upon study it was seen from the power computations that for a given lift and submergence the power required was proportional to the free air, the free air required decreased with the quantity of pulp, and the quantity of pulp decreased as the percentage of solids increased. In other words, if the solid content is constant, a reduction in the amount of water lifted reduced the power requirement. But, simple as this conclusion seems, there is nothing to indicate the relative savings in power effected by a reduction of pulp dilution.

To show the relative savings in power, a triple computation for power requirements was made, lifting a definite quantity of ore as a 30 per cent pulp, a 40 per cent pulp, and a 60 per cent pulp, with the same lift and submergence in each case. These figures are quite interesting and will be presented in part, despite any criticism as to the accuracy of the method of computation.

Assumed solids per mill per twenty-four hours, 3,500 tons.

Elevation of the mill above sea level, 7,000 ft.

Specific gravity of the ore, 2.66.

Per Cent Solids	Specific Gravity of Pulp	Pulp, Gallons per Minute	Free Air, Cubic Feet per Minute
(*a*) 30	1.26	1,390	610
(*b*) 40	1.33	1,090	495
(*c*) 60	1.59	612	298

	Brake hp., Single-Stage Compressor	Brake hp., Two-Stage Compressor	Brake hp., Ft.-lb. Method	Relative Brake Hp.
(*a*)	85.7	74.2	83.3	1.00
(*b*)	72.8	62.8	70.0	0.85
(*c*)	47.7	42.0	46.7	0.56

Upon inspecting the above tabulation, the preceding statements as to the economy in power that may be effected by a reduction of pulp dilution are justified.

In conclusion, I call attention to the fact that in actual operation of the air lift, the normal consistency of the pulp is 70 per cent solids, which is about the same consistency as the tube-mill product, but more watery in appearance, owing to the presence of the larger particles.

"Coorongite" in Australia

At the Coorong, a part of the coast of Encounter Bay, South Australia, a substance has been found which has been named "coorongite," and concerning the oil-bearing qualities of which there is much controversy in Australia. A visiting oil geologist (E. M. di Villa), when asked concerning the value of this substance, said his opinion was that it originated in the Tertiaries, being animal and vegetal matter in a state of change into petroleum. Owing, however, to the unfavorable attitude of the strata when the country became flooded and the strata saturated, the unformed mineral oil was forced to the surface by water pressure, and exposure to the air resulted in the evaporation of its lighter constituents, the mass called "coorongite" remaining behind.

Marketing of Nickel

An Essential War Metal Which Is Finding Increased Peace-time Application

By Edward H. Robie
Assistant Editor

THE WORLD WAR probably revolutionized the economics of the nickel industry to a greater extent than it did that of any other metal. Not only are the uses of the metal considerably different from what they were ten years ago, but the alignment of the selling agencies has been changed, and prices have undergone a violent revision downward. This last fact, incidentally, has resulted in marked economies in the production of the metal.

During the World War, and the years immediately preceding, the principal use of nickel was for munitions—largely armor plate. The proportion so used has never been authoritatively reported, but it was probably at least one-half of the total world production. Since 1918 the amount of nickel-steel required for armament has been insignificant. But the producers had been left with large stocks of the metal, to say nothing of enlarged mines, smelters, and refineries, so that unusual efforts were made to find new uses for nickel, to expand the old industrial outlets, and to perfect the metallurgy so that the metal would have an enlarged field of adaptability. In all of these directions success has been achieved, so that the present consumption of nickel is greater than it was before the war, despite the fact that the most important pre-war outlet has virtually been closed.

Steel Industry Chief Consumer

The principal use of nickel is still for the manufacture of alloy steel, and it is probable that about 65 per cent of the production is so used. The nickel content of most of the nickel-steel is from 1 to 5 per cent; sometimes as high as 50 per cent for special purposes. Chromium, too, is often added, and sometimes other rare metals.

Nickel increases the hardness and strength of steel without causing a corresponding loss of ductility. Possibly the principal use of nickel-steel is now for automobile parts, though it finds a wide field as a high-speed tool steel, and is also used for bridge construction, die blocks, railroad and power-plant equipment, general machinery, and ordnance. Sometimes nickel alloyed with carbon and silicon is purchased for steel manufacture, the alloy being more easily melted than pure nickel. Among the most important steel manufacturers who buy nickel for alloying purposes are: Bethlehem Steel Co., South Bethlehem, Pa.; Central Steel Co., Massillon, Ohio; Carnegie Steel Co., Pittsburgh, Pa.; Illinois Steel Co., Chicago, Ill.; National Tube Co., Pittsburgh, Pa.; United Alloy Steel Corporation, Canton, Ohio; Interstate Iron & Steel Co., Chicago, Ill.; Crucible Steel Co. of America, New York; Alan Wood, Iron & Steel Co., Conshohocken, Pa.; Carpenter Steel Co., Reading, Pa.; Erie Forge Co., Erie, Pa.; Andrews Steel Co., Newport, Ky.; and the Donner Steel Co., Buffalo, N. Y.

A second important outlet for nickel is in the electroplating industry, the uses of nickel plate being many and well known. Prominent among the buyers of nickel for anode manufacture are A. P. Munning & Co., Matawan, N. J.; Harshaw, Fuller & Goodwin Co., Cleveland, Ohio; and the Hanson & Van Winkle Co., Newark, N. J.

Alloys other than steel form a third prominent use for nickel, and one that is growing rapidly. Nickel-silver (formerly known as German silver) is an extremely useful alloy, being employed in the manufacture of tableware, jewelry, restaurant equipment, watch cases, keys, and hospital and soda-fountain accessories. Buyers of nickel for these purposes include the American Brass Co., the Scovill Manufacturing Co. and the Waterbury Rolling Mills, all of Waterbury, Conn.; the Seymour Manufacturing Co., of Seymour, Conn.; and numerous other brass companies.

Monel metal is an alloy that has been developed by the International Nickel Co., which is the sole producer. In making this alloy, the copper and nickel as it occurs in the ore is not separated, only the iron and sulphur being removed from the natural minerals. The alloy contains about 67 per cent of nickel, 28 per cent of copper, and 5 per cent of iron, manganese, silicon, carbon, and other elements. Monel metal has the tensile properties of steel, the appearance of nickel, and will withstand acids, high temperatures, sea water, and hot gases and superheated steam.

An alloy of somewhat similar composition, though made by synthesis of the pure metals, has recently been put on the market by the Mond company. Copper-nickel alloys are also used widely for coinage, bullet jackets, wire, and bronzes. Any complete list of alloys will give many other combinations of nickel with other metals for special purposes, an outlet for nickel that is rapidly widening. Special mention should be made, however, of the heat resistant alloys of nickel as made by the Hoskins Manufacturing Co., of Detroit, Mich.; the Driver-Harris Co., of Harrison, N. J.; the Electrical Alloy Co., of Morristown, N. J., and others.

A new alloy known as "Permalloy" also deserves mention. This contains about 80 per cent nickel and 20 per cent iron and a special heat treatment is used in its preparation. It has extraordinary magnetic permeability, being by far the most easily magnetized and demagnetized of all known metals.

An increasing amount of nickel is also being sold for the manufacture of pure nickel castings and sheets, from which various articles are manufactured. The development of malleable nickel, as by the Madsen, Hennig, and other processes, has aided this outlet. Madsenell nickel is electrolytic nickel which has been deposited in commercial form by a special process; other forms of malleable nickel are made by removing the slight amount of nickel oxide present in the ordinary form of the metal, usually by introducing magnesium. Nickel is also sold in the form of salts, which find an outlet in the electro-plating industry. Further, it is used as a catalytic agent in the hydrogenization of Crisco and similar vegetal fats.

As will be apparent from the foregoing, most of the

nickel consumed in the United States goes to the steel, brass, and electro-plating industries in Ohio, Pennsylvania, New Jersey, New York, and Connecticut. A considerable amount of nickel is also used in Europe by similar industries.

The purpose for which nickel is to be used naturally governs the shape in which it is sold. The large steel furnaces ordinarily buy ingots, which are sold in either 25- or 50-lb. sizes. The 50-lb. ingots weigh a few pounds less than 50 lb. usually, whereas the 25-lb. ingots may run a little over. The larger size are cast with top dimensions about 5x15 or 16 in., bottom dimensions, 2½x12 in., and 3 in. thick. The small ingots are 3½x14 or 15 in. long on the top, 2x10 in. on the bottom, and from 2½ to 3 in. thick. They may be shipped either in barrels, boxed, or in bulk for the larger size. Electrolytic nickel is sold in the form of cathodes, 2x3 ft. in size, and from $\frac{3}{16}$ to ½ in. thick. For the convenience of the customer, these are sometimes cut up into desired sizes, and often bundled in 25- or 50-lb. parcels, a small extra charge being made. For use in smaller furnaces, nickel in the form of shot or pellets is favored, these being sold at the same price as ingots, and packed in barrels of 500 lb. net. These forms comprise practically all those in which the crude metal is sold in this country, but some of the producers have added greatly to their marketing facilities by manufacturing sheets, wire, and other forms of the metal, black and green nickel oxide (both of which have the formula NiO), and reduced nickel, in a finely divided state. Cubes and rondelles are made in foreign works, but there is little or no demand for nickel in this form in America. Rondelles are disks about 1½ in. in diameter and ¾ in. thick, weighing about 4 oz. each; the principal market is in China. Cubes are sold principally in Europe.

The largest part of the nickel that is sold is fire-refined ingot metal of analyses *A*, *B* or *C*, as shown in the following table:

Typical Analyses of Several Commercial Brands of Nickel

	Per Cent									
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Nickel.....	98.45	98.55	97.95	99.25	98.20	98.80	99.15	99.80	99.50	99.35
Cobalt.....	0.55	0.55	0.55	0.55	0.50	0.45	0.45	Nil	....	....
Nickel plus cobalt....	99.00	99.10	98.50	99.80	98.70	99.25	99.60	99.80	....	....
Iron.....	0.50	0.40	0.55	0.10	0.60	0.50	0.23	0.05	0.30	0.45
Carbon.....	0.10	0.15	0.40	Trace	0.02	None	None	0.05	0.10	0.10
Silicon.....	0.15	0.15	0.25	None	None	None	None	0.02	0.04	0.04
Sulphur....	0.05	0.03	0.05	Trace	0.02	0.014	0.014	Nil	0.01	0.01
Copper.....	0.20	0.17	0.25	0.03	0.10	0.06	0.06	Nil	0.05	0.05

A represents a fire-refined nickel sold in ingot form in the largest amount of any brand. *B* and *C* are two popular brands of nickel shot; *B* is used for alloys and for crucible nickel steel; *C* by nickel anode makers, as it is more fusible. *D* is the brand of electrolytic nickel sold by one of the producers. *E* is the brand of electrolytic nickel sold as cathodes by another producer; when remelted and sold as shot or ingots it is marketed in two grades as shown by analyses *F* and *G*. *H* is the grade of nickel refined by the Mond volatilization process, freedom from cobalt being the feature of this brand. When made into malleable nickel it contains about 99.35 per cent of pure nickel. *I* and *J* represent ingot and shot nickel respectively, as made in this country from New Caledonian matte.

Formerly, when practically all of the nickel sold in the United States was marketed by one producer who had only a limited amount of electrolytic nickel to offer, a premium of about 3c. per lb. was exacted for the pure electrolytic grade largely used by the nickel-silver industry. Recently, with more competition, it has not always been possible to get this premium, though it is still nominally quoted. Nickel of the highest purity in general commands somewhat higher prices than the lower grades, but the amount of the premium depends to a large extent on the amount of competition and whether the consumer thinks he must have only the very highest grade. It is of interest to observe that electrolytic nickel is not necessarily any purer than fire-refined nickel, as the preceding analyses will show. Extreme purity is not commonly necessary; in making alloy steel, for example, iron is not an undesirable contaminant, and may even be beneficial; cobalt is also usually considered of equal value to nickel.

Nickel is sold by the producers in any quantity desired, whether it be a hundred pounds or so, or that many tons. The terms are usually one-half per cent discount for settlement within ten days; net cash, thirty days.

No special requirements as to sampling or assaying are ordinarily made. The character of the various brands is well known by regular consumers, and they merely specify the grade required, trusting the producer to keep the product up to standard. The product actually delivered usually exceeds the guaranteed analysis in purity.

Nickel is a comparatively new metal; it was not discovered until 1751. It was not used commercially until 1828, and in only a small way until about 1870. Its use on a comparatively large scale has been confined to the last forty years, when the large sources of supply in Ontario have been developed coincidently with the development of the principal outlet—nickel-alloy steel. Until 1876, the supply of nickel came from several small or low-grade deposits which have been discovered in various parts of the world. Then the New Caledonian deposits of garnierite (a silicate of nickel) were discovered, and for the next few years that French province was the most important source of the metal. In 1883, the nickel deposits of Ontario were discovered, in making a cut for the transcontinental Canadian Pacific Ry. For the next twenty years, Ontario and New Caledonia produced nickel in substantially equal amounts, but since 1905 Ontario production has rapidly outstripped that of its antipodean competitor. Still, the New Caledonian deposits are in strong hands and the industry there is likely to be long lived.

In the Sudbury district of Ontario, copper-nickel-iron sulphides in intimate association are found in an elliptical belt a mile or so wide and with a peripheral length of about 90 miles. Undoubtedly, there are vast reserves of ore, both discovered and undiscovered, and unless richer deposits of nickel ore are discovered elsewhere, this district promises to be the premier producer for hundreds of years to come.

Conditions Now Highly Competitive

Until the World War, the principal producer was the International Nickel Co. (formerly the Canadian Copper Co.), which had a monopoly of the American market and also competed in foreign markets. The only other producer was the Mond Nickel Co., which shipped all of its nickel to Wales for refining, and sold exclusively in the foreign market. The International company, from the time of its formation in 1902 having a monopoly of the American market, practically fixed the price of its product, keeping it high enough to assure what it considered a reasonable profit, and low enough to encourage consumption. There was no open market for the metal, so there is no record of prices. On contract business the price probably varied between 34 and 40c. per lb. during the years 1902 to 1921, with possibly a wider variation in individual sales, determined by the demand. It is probable that more than

three-quarters of the nickel produced is sold on long-term contracts at a fixed price. Recently, however, consumers have insisted on an adjustment in the event of any marked decline in the spot price.

Since the World War, another producer has begun operations in Ontario, the British America Nickel Corporation, which has established a selling agency in New York and thus started the competition with the International company, which had much to do with the markedly low prices of 1922 and succeeding years. Also, the Mond Nickel Co. has established a rolling mill and a selling agency in the United States—the American Nickel Corporation—shipping nickel matte from Canada to Wales for refining, and then sending part of the finished metal back across the Atlantic for sale. For some years past, the Ballande group in France, operating New Caledonian mines, has also maintained a refinery at New Brunswick, N. J., under the name of the United States Nickel Co., which sells a hundred tons a month or so in the United States. The following table shows the rate of production in the summer of 1924 and also the plant capacities:

American Nickel Producers

Name	Tons of Nickel Produced per Month, Summer of 1924	Plant Capacity, Tons of Nickel per Month
International Nickel Co.	1,750	2,000 (*a*)
Mond Nickel Co.	600	625
British America Nickel Co.	400	625
United States Nickel Co.	65	225
Byproduct from miscellaneous plants	10	10

(*a*) Limited by refinery. Smelter capacity about 3,500 tons.

It is evident that the total plant capacity, which could easily be increased, is well above the present rate of production, and a bitter price war has been going on for a year or two. In time, it may be that some combination of two or more of the producers will be effected, or some of them will be forced to suspend operations. Probably none of them are making reasonable profits under present conditions. It is also evident that if a new producer should come into the market he would have an uphill fight, to win which he would have to have an exceptional deposit of ore. There is little or no market for small amounts of low-grade ore.

Prices quoted to various consumers by the same producer at the same time often vary within a range of three or four cents, depending upon the degree of competition and the standing and astuteness of the buyer. Rumors of price cutting are frequent, and in the spring of 1924 it is probable that considerable nickel was sold from 21 to 25c. per lb., though the market was nominally 27 to 30c.

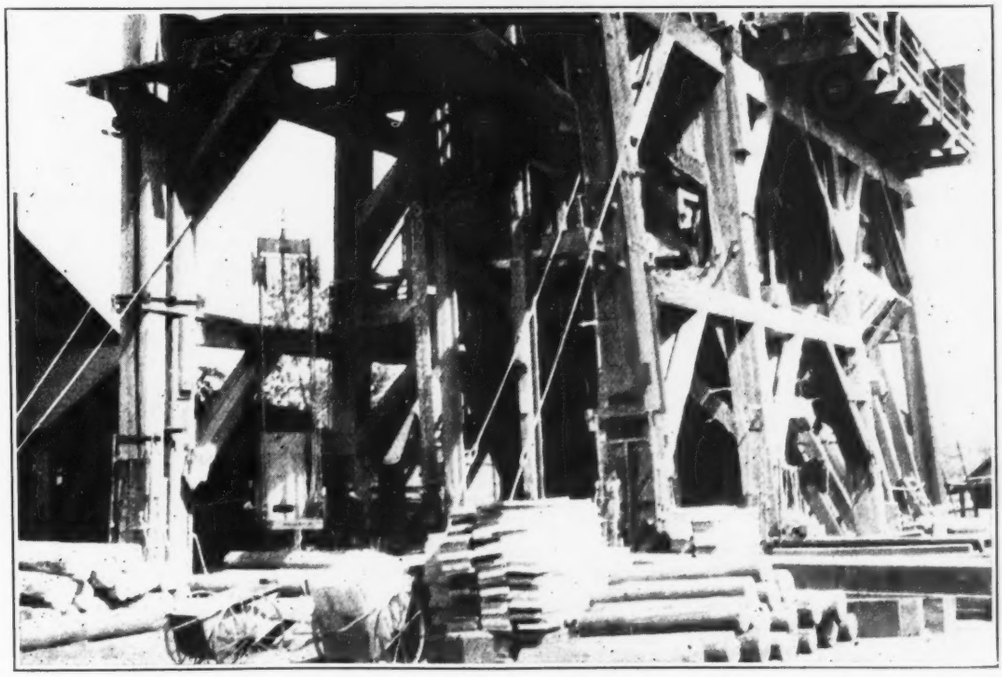
Estimated World's Production of Nickel

In Tons of 2,000 Pounds

	Sudbury District, Ontario (*a*)	New Caledonia (*b*)	World Total (*c*)
1900	3,540	6,584	8,280
1901	4,441	5,800	9,800
1902	5,945	5,600	9,600
1903	6,998	3,400	10,900
1904	4,729	4,300	13,200
1905	9,503	6,627	13,800
1906	10,776	5,200	15,700
1907	10,602	5,200	15,500
1908	9,563	4,700	16,100
1909	13,141	3,700	19,000
1910	18,636	5,237	22,200
1911	17,049	7,500	27,000
1912	22,421	5,800	31,400
1913	24,838	4,929	33,700
1914	22,759	5,600	33,100
1915	34,039	2,569	42,000
1916	41,299	3,900	49,000
1917	41,887	4,300	50,000
1918	45,886	2,800	52,000
1919	22,035	2,000	26,000
1920	30,615	2,400	34,000
1921	9,628	1,660	12,000
1922	8,667	.....	10,000
1923	31,028	.....	33,000

(*a*) Nickel content of Bessemer matte produced.
(*b*) Production estimated by assuming exports of ore to average 4.8 per cent nickel, and matte, 45 per cent nickel.
(*c*) 1900-1914 refined nickel production as given by the Metallgesellschaft. 1915-1920 nickel content of ore, matte, and metal as given by the Imperial Institute. 1921-1923 figures are author's estimates.

California's Deepest Vertical Shaft



Kennedy shaft, Kennedy Mining & Milling Co., Jackson, Calif.
The deepest level is at 4,200 ft.

The Southern Experiment Station —Its Problem and Purpose

Anticipates Future Needs by Studying Possibilities of Washing Low-Grade Iron Ores—Research of Present Value Also

By A. H. Hubbell
Managing Editor

LOOKING AHEAD to the time when the operators of the Birmingham district in Alabama will have drawn so far on their reserves of iron ore that the large tonnages of low-grade iron ores of the Southern District will have become commercially important, the U. S. Bureau of Mines established one of its mining and metallurgical experiment stations at Tuscaloosa, 60 miles southwest of Birmingham, Ala., in January, 1921, for the purpose of studying ways of beneficiating these ores. This station is housed in the buildings of the University of Alabama, with which the Bureau has a co-operative arrangement for research work.

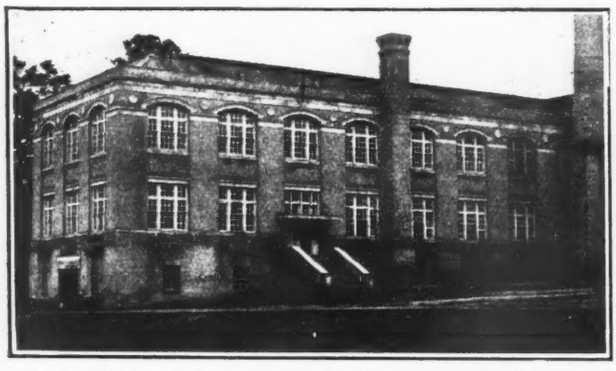
Beneficiation of the low-grade iron ores of the so-called Southern District, including Alabama, Tennessee, Georgia, Kentucky, North and South Carolina, Virginia, and Florida, is the major problem selected for the station. This has been divided into four individual problems, as follows: (1) High silica red hematites; (2) gray specular hematites; (3) the brown iron ores; (4) blast-furnace flue dust. Work on these problems has been under way for some time, though delayed by the necessity of re-equipping the station in part. From the time it was established until recently the station had been doing experimental work on non-metallic ores. About six months ago such work was transferred to the new Non-metallic Experiment Station that was established at New Brunswick, N. J., last year. This transfer leaves the Southern station free to devote its entire time to the problems of ore concentration mentioned.

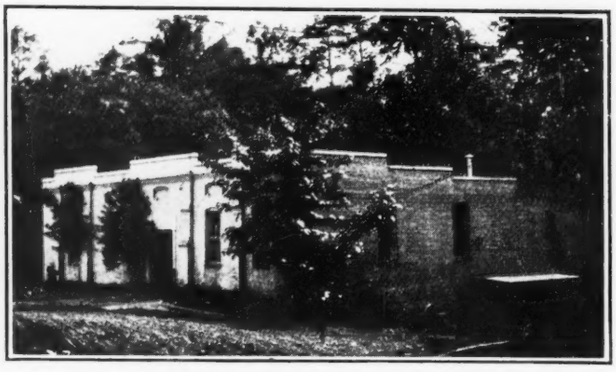
A problem of a different sort from the technical ones assigned to it is that of securing the attention of the operators of the district and enlisting their active aid. Not that the operators do not know of the station or are opposed to it. Indeed, they generally approve of it and its purpose, and are said to be co-operating to the utmost in furnishing large samples of ore, together with information to aid in furthering the work. Four railroads in the district have agreed to give free transportation to ore shipments made to the station. But the fact that there appears to be no immediate need of washing the low-grade ores—that it may be ten years or more before that course becomes an economic necessity—may tend to keep some from co-operating as enthusiastically as they might otherwise do if the pressure of need were upon them. If this be the case, the only answer is that it may take ten years or more to work out the problems of concentration to a satisfactory solution, and that the harder the work is pushed the better it will be for the district.

It is well recognized that the ores that are now worked will not last forever; and that part of the Big Seam, in Red Mountain, that is now left, will eventually be worth mining. But where the entire thickness of a seam is not worked today there is some question, in cases at least, whether it will ever be possible to recover the rejected portion, owing to crushing and caving of the ground. If not, it might be better, from the viewpoint of one seeking to conserve the iron resources of the district, to mine the entire thickness of the seam, taking the poor stuff with the good, and washing it. This is theoretical, of course, but it is one of the things that the Bureau's experimental work can decide, and it is worth deciding soon. The more help the station receives from the operators the better.

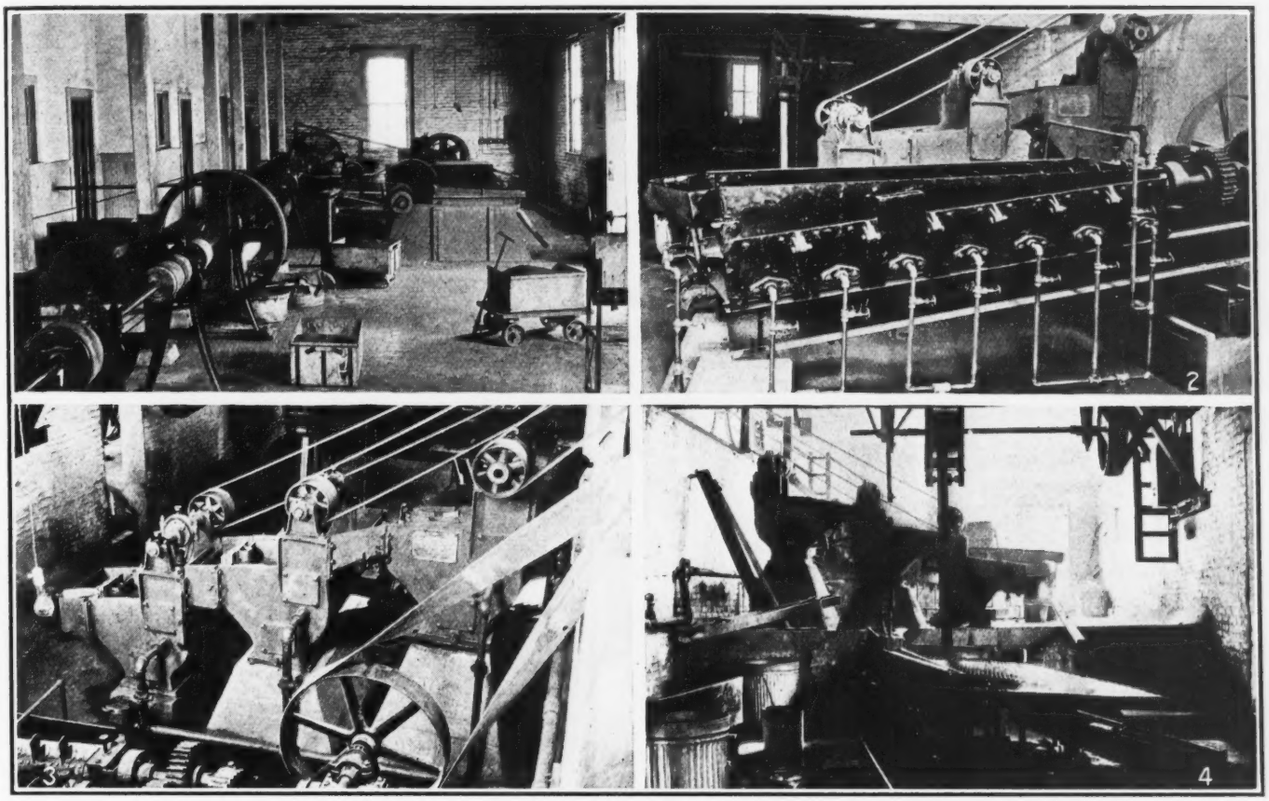
The offices of the experiment station are in a wing of Comer Hall, at the university. They are provided with a technical library of about 2,000 volumes, containing Bureau of Mines and state publications, technical books on ore dressing, and the principal technical magazines. Here are also located the chemical laboratories, one general laboratory, and four small ones for individual investigation. A sample preparing room in the basement contains equipment for grinding, screening, and drying. Other rooms are used for repair work, for testing, and for storing supplies for the office and laboratories.

The main ore-dressing laboratory occupies the building shown in the illustration, about 150 ft. from Comer Hall. It is 55x75 ft. in dimensions, with three floors, staggered in arrangement to permit the gravity flow of ore samples tested. This laboratory is provided with equipment of semi-commercial size, including a jaw crusher, rolls, a gyratory, and shaking screens. For gravity concentration there is a log washer with a Greenway hutch attachment and a three-cell Woodbury jig, a





Left—Wing of Comer Hall, University of Alabama, where the offices and chemical laboratories of the Southern Station are housed. Right—Ore-dressing laboratory



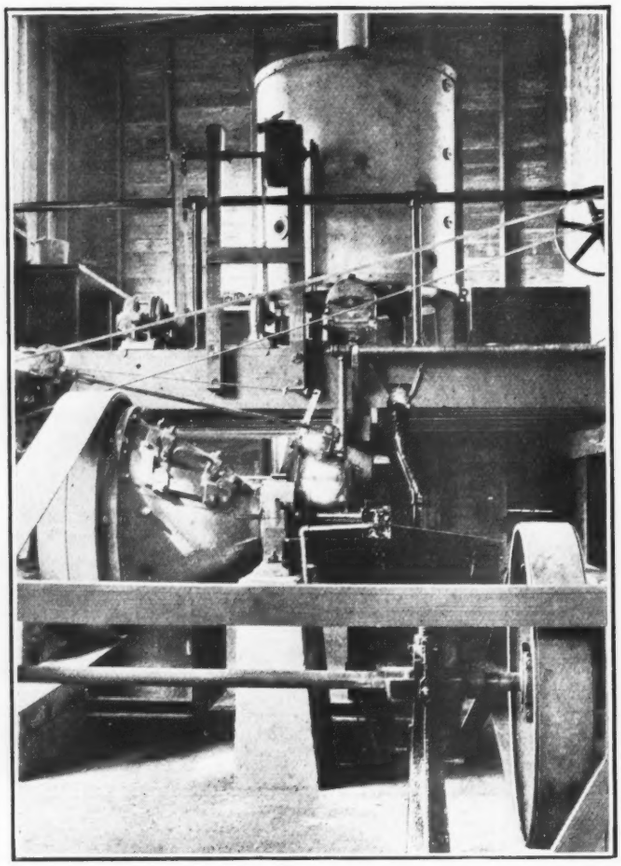
Some of the equipment in the ore-dressing laboratory

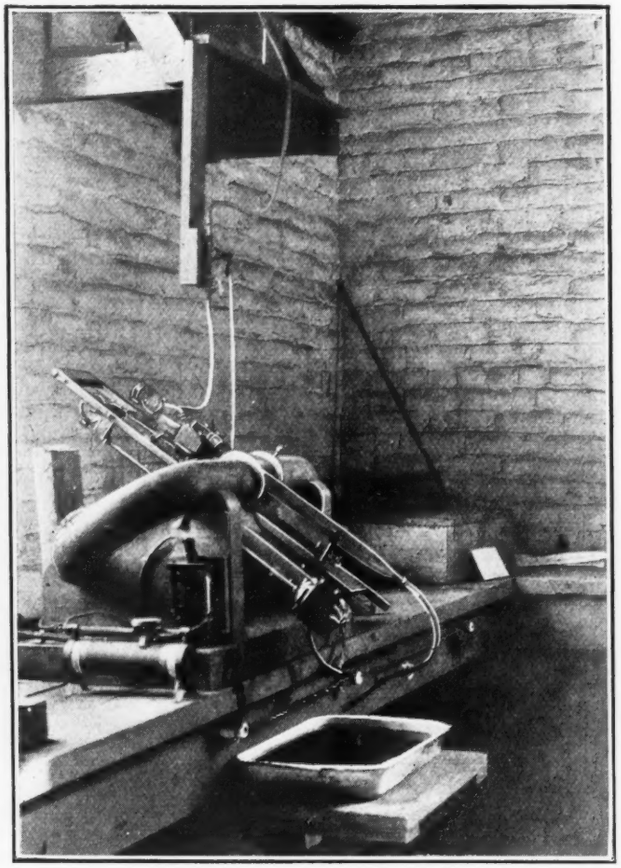
1. Crushing and screening machinery. 2. Log washer with Greenway hutch. 3. Three-cell Woodbury jig. 4. General view of Deister-Overstrom table, Woodbury jig, and log washer

Deister-Overstrom table with two interchangeable sand and slime decks, a Wilfley table, a sand pump, and a large steam drier. For roasting and magnetic concentration there is a 36-in. six-hearth Herreshoff roaster; an 8-in. by 3-ft. Hardinge mill in closed circuit with an 8-ft. duplex Dorr classifier; a 5-ft. Davis magnetic log washer; and a three-cone Deister vortex classifier. A 36-in. wet magnetic cobber for handling coarse magnetic material and a dry magnetic grader are to be added soon. Further details as to the equipment provided are given in the following, for the benefit of those who are interested:

1 Ro-tap testing sieve shaker, W. S. Tyler Co. on ¼ hp. Robbins & Myers a.c. motor.
1 No. 2 Blake jaw crusher, Denver Fire Clay Co.
1 Type UA Braun disk pulverizer, F. W. Braun, Los Angeles.
1 emery wheel, Goodell-Pratt Co., Greenfield, Mass. Pulverizer and emery wheel are on a line shaft operated by a 5-hp. G.E. induction motor.
1 No. 4 Milford power back saw machine, Henry G. Thompson & Son Co., New Haven, on ½-hp. Robbins & Myers a.c. induction motor.
1 detachable drill press, Van Dorn Electric Tool Co.
1 Monroe hydraulic classifier for small tests.
1 2½x5-ft. four-burner gas drier with wire shelves.
1 4x4-in. laboratory gas-fired roasting drum for reducing ore sample. Dumps into water to prevent reoxidation. Temperature determined with thermocouple. All housed in asbestos box. Run by 1/20-hp. Westinghouse a.c. motor.
1 small laboratory sintering machine, made on Dwight & Lloyd principle, gas-ignited. After starting, down draft is secured by a No. 1 Nash Hytor vacuum pump run by 5 hp. G.E. induction motor.
1 steam drier for heating to 212 deg.
1 Rogers-Conklin Manufacturing Co. jaw crusher, Joplin, Mo.
1 small gyratory "coffee mill" for fine crushing.
1 pair 18-in. rolls, housed.
1 2x4 ft. shaking screen, operated by eccentric head motion. The four machines are on one line shaft, run by a 20-hp. G.E. a.c. induction motor.
1 Davis magnetic tube for magnetic assay. This consists of a 2-ft. glass tube 1½ in. in diameter, passed with 4-in. stroke between the two poles of an electromagnet. Handles 8-mesh material and smaller.
1 laboratory Case flotation machine, Denver Fire Clay Co., run by ⅛-hp. G.E. d.c. motor.
1 two-cell jig (5x8-in. cell). General Engineering Co., Salt Lake City, Utah.
1 Allis-Chalmers motor-generator set for magnetic work. 5 hp. a.c. motor; 3-kw. 110-volt d.c. generator.
1 36-in. six-hearth gas-fired Herreshoff roaster; is split lengthwise, and the two halves can be pushed apart. Run by 1-hp. G.E. a.c. induction motor. Combustion on each of three lower hearths is controlled with a thermocouple.
1 8-ft. Dorr rake classifier.
1 8x36-in. Hardinge mill.
1 5-ft. Davis magnetic log washer, run by ¼-hp. G.E. a.c. induction motor.
1 No. 12 Wilfley table.
1 Deister-Overstrom sand and slime table with interchangeable decks. Deck area one-quarter commercial size.
1 three-cell Woodbury jig, half commercial size. Worthington Power & Mining Machinery Works.
1 Greenway turbo log washer, Allis-Chalmers.
1 24-in. Hardinge mill.
2 electric muffle furnaces.
4 balances (3 Becker, 1 Voland).

The Southern Experiment Station is under the supervision of Dr. Walter R. Crane, superintendent of the Southern District, who directs its work from the Birmingham office of the Bureau. At the station, Oscar Lee, associate metallurgist, is in charge of the investigative work. The staff includes, besides, at the present





Left—Herreshoff furnace, Hardinge ball mill, and Dorr classifier, in ore-dressing laboratory. Right—Davis magnetic tube for magnetic assay

time, two technologists, two mechanics familiar with ore-dressing equipment, one chemist, a clerk, and a laborer. An assistant chemist is provided by the state to run coal analyses (the only coal work done at the station) and assist in research work on iron ores.

Under the co-operative arrangement that the Bureau has with the university, there are five fellowships in research work. The five incumbents are paid by the state, and spend nine months of the year at the station, where they are assigned to definite problems and assist in the work of the ore-dressing laboratory under the direction of the Bureau staff.

Some results have already been obtained that are encouraging for the future, despite the delay caused by the changes at the station. Work has been started on preliminary tests on a small scale to obtain fundamental data as a basis for work on a larger scale.

In connection with the experimental work being conducted at Tuscaloosa, a comprehensive study of iron-mining methods in the Birmingham district has been made by Dr. Crane, to obtain information on the working conditions in the mines and the occurrence of the ore as it affects conditions of development and mining, including support, drainage, and ventilation. In this underground study practically every important iron mine in the district was visited.

An important problem connected with cheaper costs of mining is the size of pillars that must be left to support the workings. To obtain data on this point, blocks of ore have been cut from various sections in the ore bed, and these are being cut into cubes which will be subjected to crushing tests.

Record Output of Fuller's Earth in 1923

The largest output on record of fuller's earth is reported by the U. S. Geological Survey, working in co-operation with the state surveys in Alabama, Florida, Georgia, and Illinois, fifteen operators in six states reporting that 149,134 short tons of fuller's earth was sold in 1923, valued at $2,247,523, or $15.07 a ton. This output is 7 per cent greater than that of 1922, but it is nearly four times the output of 1913. The value of the output for 1923 was the third largest that has ever been recorded, and was exceeded by that of 1920 and 1922. It was six times as large as that of 1913. Since 1920 there has been a steady decline in the average price per ton, the price in 1923 being nearly $4.50 lower than that of 1920.

The South continues to produce the greater part of the output. Florida was the leading state in output and value, as it has been from the beginning of the industry. Georgia was second and Texas was third in output and value. These three states reported about 92 per cent of the output and value in 1923. The producing states in the order of their output follow: Florida, Georgia, Texas, Illinois, Massachusetts, and Alabama.

Imports of fuller's earth, which at one time constituted the entire supply, reached their maximum quantity in 1914; since then they have on the whole declined and reached their lowest quantity in more than twenty-five years, 8,547 tons. The value in 1923 was $113,944, or $13.33 a ton. The value of imported fuller's earth in 1923 was the lowest that has been recorded since 1909.

Trend of Mining Industries on the Pacific Coast

By George J. Young
Associate Editor

THE IMPORTANT copper production of the Pacific region is derived from Arizona, Utah, Nevada, California, and Alaska. Idaho, Oregon, and Washington are relatively less important. Visualizing the industry from 1912 to 1923, inclusive, indicates an ascending curve of production interspersed by peaks and valleys. The copper production of the region in 1912 was 661,027,835 lb.; in 1923, it was 965,108,300 lb. The rate of increase averaged 25,340,038 lb. per annum. A pronounced peak of production characterized 1916, '17 and '18. All of the production curves declined greatly to 1921, and since have risen sharply. The production was 297,736,128 lb. in 1921. This was due to the abnormal reaction following the war period.

From a production viewpoint the copper industry in this region is in a healthy condition. The present unattractive price has had the effect of consolidating the individual parts of the industry and putting the respective mine managements on their mettle in increasing efficiencies and recoveries. Much has been done in this respect, and any price advantage that may accrue or any lowering of the commodity index through lower taxation will have an immediate effect upon profits. This elimination of lost motion from an industry is, after all, a good thing, although painful. I look optimistically upon the position of copper and anticipate a period of considerable prosperity for low-cost producers.

Lead in the Pacific Coast States

Of overshadowing importance in the lead production of the Pacific region are Idaho and Utah. Arizona, Nevada, and California are in a subordinate position, and Washington, Oregon, and Alaska are of lesser importance. Viewed over the interval from 1912 to 1923, inclusive, production for the group increased at the rate of 4,237 tons of lead per annum. The aggregate was 198,964 tons in 1912 and 249,813 tons in 1923. Idaho records a peak of 174,045 tons in 1917 and Utah 111,789 tons in 1916. The decline in production was rapid, Idaho registering a low point in 1919 and Utah similarly in 1921. Since, both states have substantially increased their output. Arizona, Nevada, and California produce individually less than 10,000 tons per annum. In 1916, Arizona produced 15,328 tons. Generally these states have production curves that indicate a declining tendency, although the production is now trending upward. If they maintain 10,000 tons per annum individually they will be doing well.

How long the premier lead states can continue to produce at the present rate or better is problematical. The production is coming principally from old mines. A decline therefore appears probable in relatively few years unless new deposits are discovered. Trail, B. C., produced 47,970 tons in 1923, and as the Sullivan mine has large ore reserves, this production may be expected to continue.

The position of lead in these states is sound and the industry is healthy. An increased activity in the search for new lead properties will undoubtedly yield results; a discovery of another Bunker Hill mine may not be made, but more modest producers will undoubtedly compensate in part for any decline in production. There is opportunity, in my opinion, for better metallurgical results in ore treatment and greater economy in operation. However, the lead miners are warranted in being optimistic.

Zinc in the Pacific Region

Zinc is not a conspicuous metal in the Pacific region. Idaho, Utah, and Nevada are the important zinc producers. Both California and Arizona have produced considerable zinc and may become of greater importance. Washington also produces more or less zinc, but neither Alaska nor Oregon is of importance. The aggregate Coast production of zinc amounted to 19,700 tons in 1923 (not including British Columbia). In general, zinc production has declined in all of the states since 1916. Idaho produced 43,253 tons in 1916 and 5,600 tons in 1923; Utah produced 14,786 tons in 1916 and 5,600 tons in 1923; Nevada produced 16,222 tons in 1916 and 7,000 tons in 1923. All three states show an increase for 1923 compared to 1922. Future production in these states may be expected to increase as the facilities for the reduction of zinc ores grow. This is especially so of Idaho, as plans are in preparation for the erection of a zinc-treatment plant at Kellogg, Idaho, by the Bunker Hill Mining & Concentrating Co.

The Shasta Zinc & Copper Co.'s plant in California is dormant, and may not be revived, at least for some time. The center of zinc production on the Pacific Coast is at Trail, B. C., where a production of over 30,000 tons was made during 1923. Undoubtedly, other zinc plants will be established, but more conservative action is to be expected than in other kinds of mining. Zinc mining is one of the activities that will attain future importance as industrial development opens out local demands for zinc and its products. Already the rubber-manufacturing industry has grown to considerable importance. Recent developments in the Coast iron and steel industry also promise an expanding local market for zinc.

Gold Mining Status of Pacific Coast States

Gold was discovered by Marshall in the Pacific region on Jan. 24, 1848, slightly more than seventy-five years ago. Its discovery was the catalytic that started mining in these states and has been responsible for a considerable part of the substantial mining industry that has supplied the sinews of war and commerce. Its present status is of interest. Comparison of the production figures from 1912 to 1923 is instructive. California records a peak for 1915, a production of well over 1,100,000 oz. Since that time production has declined at somewhat less than 58,000 oz. per year. In 1923, production was 665,051 oz. In 1922, the gold dredges, thirty-five in number, contributed 249,960 oz. The number of gold dredges now in operation is estimated to be twenty-four. Most of these dredges will have worked out their available ground within seven or eight years. The placer gold production may be expected therefore to be steadily curtailed and become unimportant within a relatively short time.

lode mining is barely holding its own. More extensive work on smaller properties will undoubtedly maintain production not greatly below the present production of lode properties. Nevada's gold production diminished steadily from 673,000 oz. to 160,254 oz. in 1922, but increased to 195,227 oz. in 1923. Alaska's gold production has diminished since 1912 at the rate of 47,500 oz. per annum, and was 309,653 oz. in 1923. Arizona's production reached a peak in 1918 corresponding with the peak production of copper. It reached a low point in 1921, but since then has increased and will maintain itself around 300,000 oz. per annum, as gold production is to a considerable extent a byproduct of copper.

Utah shows a slow decline to a low point of 85,619 oz. in 1921. Since then production has increased. Gold production in Idaho, Oregon, and Washington is relatively small and shows a diminishing tendency, although in 1923 Idaho and Washington indicate small increases over 1922. The aggregate production of the seven states and one territory shows a decline of 1,358,206 oz. in gold production by comparing the production of 1912 and 1923. The rate of decline is 113,183 oz. per annum for the twelve-year period for the group. Two fundamental causes explain the decline; one is the absence of noteworthy discoveries in sufficient number to sustain production, and the other is the high economic index which has prevailed during and since the World War. The latter has resulted in higher costs, which have materially raised the ore grade limit of profitable mining. As has been remarked before, excessive taxation is the fundamental cause of high costs. The gold miner is one of the end men who cannot pass along any of the cost increment to the user of gold. He is in need of great encouragement and is worthy of it. The gold-mining industry requires leadership of a high order, for the difficulties of organization have increased and financing of mines requires strong hands.

Silver Production of Pacific Region

The trend of silver production as an index of mining activity from 1912 to and including 1923 with reference to the Pacific region is of interest. The three great silver-producing states are Nevada, Utah, and Idaho. In the latter two states silver production is intimately associated with lead production. In Nevada, gold is an accessory metal in most instances and lead only occasionally. Nevada made a peak production of over 16,000,000 oz. in 1913, since when production declined to about 7,000,000 oz. in 1919. It has increased considerably since. Utah passed Nevada in 1917 and in 1923 produced over 20,000,000 oz. It is now the most important silver-producing state. Idaho reached a peak of about 12,500,000 oz. in 1914 and declined to slightly less than 6,000,000 oz. in 1919, since when production has increased to somewhat less than 8,000,000 oz. Arizona reached a peak of over 12,200,000 oz. in 1916, declined to about 2,500,000 oz. in 1921, and rose to 7,200,000 oz. in 1923. California shows an irregular increase, reaching a peak of 3,700,000 oz. in 1923. Alaska produced about 687,900 oz. in 1923, and shows a decline. Oregon and Washington are relatively unimportant and silver production has declined. All five states, Utah, Nevada, Idaho, Arizona, and California, show a rising production since 1921. In 1912, the total product of the region was 42,275,769 oz.; in 1923, 50,546,800 oz. The annual increase was at the rate of 689,252 oz. This is significant of the mining vitality of the Pacific region, which produced 69.6 per cent of the United States silver production in 1923. However, although the silver miners have profited by the strength of lead, they are adversely affected by the high commodity index. Their situation would be materially improved by a broad cut in taxes. Apparently, there is little opportunity for improvement in metallurgical processes, but each individual operation can no doubt be improved by greater labor efficiency and better management. The sting of lower silver prices has at least the advantage of compelling the silver miner to improve his operations in detail. The future of silver mining can be viewed optimistically, with reservations.

Interesting Use for Bentonite

The Mines Branch of the Department of Mines of Canada has recently been investigating the subject of bentonite, with a view to determining the country's resources of this material and possible uses for it, according to H. S. Spence, mining engineer in the department. It has been found that extensive beds of the clay exist in western Canada, several of the deposits being well situated for development. No production has yet taken place, owing to present lack of a market, but the increasing interest being displayed in the material suggests that bentonite may before long figure in the list of Canadian mineral products.

The Mines Branch was recently approached by a firm anxious to develop an asphaltic water-proofing compound for use in paper board. For this purpose, the lump asphalt had to be ground to a powder, and the difficulty was that, during grinding, the fine asphalt particles became tacky and at once started to adhere to one another instead of forming a loose powder. Various substances, including ordinary clay, kaolin, and talc had been ground up with the asphalt, without overcoming the difficulty, and the Mines Branch was asked for an opinion as to the possibility of using bentonite.

The fact that bentonite assists materially in forming water suspensions of enamels and other substances, and that asphalt-bentonite emulsions can be made, suggested that bentonite might well be used to form a stable and homogeneous bentonite-asphalt mixture for the purpose in view. Consequently, the Ore Dressing Division of the Mines Branch undertook a series of tests in the grinding of asphalt-bentonite-water mixtures, as well as of asphalt with bentonite in the dry state, and of asphalt with china clay. The results of these tests show that bentonite can be used very satisfactorily, forming an exceedingly smooth, stable paste, suitable for incorporating into felt, paper, or other materials.

For the tests the asphalt was first crushed to half inch and the bentonite was ground to 100 mesh. Bentonite from two sources was used separately, for comparison, one lot being from Rosedale, Alberta, and the other from Medicine Bow, Wyo.; the latter was supplied by the Owyhee Chemical Products Co., of Chicago, being the product marketed as "Wilkinite." No material difference was perceptible in the products made from the two bentonites used. Comparative wet-grinding tests were also conducted on asphalt-bentonite and asphalt-china clay mixtures. A wet grinding test was also made on a mixture of rosin and bentonite. These tests show that the addition of 20 per cent bentonite in the wet grinding of asphalt assists materially in the securing of a fine, uniform product.

Geology of the Sado Gold Mine, in Japan

By H. Nishihara
Mining Geologist, Tokyo, Japan

H. Nishihara

THE Sado Gold Mine had been investigated by the late C. W. Purington, an article by whom appeared in the *Mining Journal-Press* of Dec. 23, 1922. In the latter part of November, 1923, I had the opportunity of seeing the mine, and observing it from a somewhat different angle. It is my earnest desire that this little article be regarded as supplementary to that of Mr. Purington, to which reference has just been made.

The Sado mine is situated on the Sado Island, 39 miles off the coast of Niigata, in the Sea of Japan. It was discovered more than 300 years ago, and is one of the oldest and longest-worked gold mines in the Japanese Empire.

As shown on the general geological map, the Tertiary sedimentary series, consisting mainly of shale and tuff, trends in a north-south direction and dips west or northwest at an angle of 40 deg. This is intruded by liparite and is covered by andesite flow.

The orebodies are fissure veins cutting through the Tertiary shale and tuff; they are closely related to a post-Tertiary liparite intrusion. The vein system consists of two parallel veins and one link vein. A mother lode, called the Takato vein, trends east and west for a distance of 7,000 ft., and on an average is 40 ft. wide. It dips south at an angle of 60 deg., and is cut by two major faults. Another vein, called Ohdate, runs 1,500 ft. north of this and in parallel for a distance of 6,000 ft., and dips south at 70 deg. There is an arched vein, called Waniguchi, splitting off the mother lode.

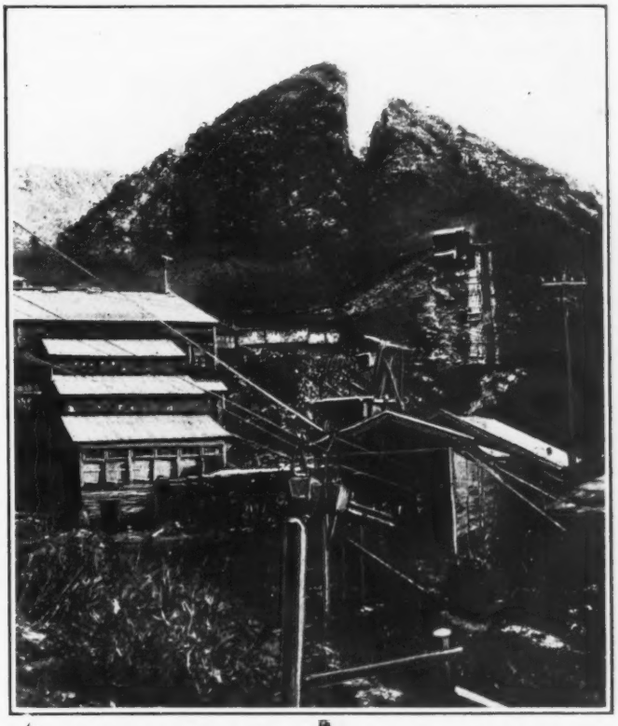
There is still another independent vein, called Nakao, some distance to the west. The vein consists mainly of quartz in the upper levels; and, besides the quartz, calcite and feldspar can be noted in the lower levels. The vein is fractured within the walls and recemented, forming the ring ore structure. The fragments of the country rock, especially of tuff, are included in the vein and to some extent they are silicified and replaced by the ore. The ore minerals include electrum—60 per cent gold and 40 per cent silver—argentite and pyrite in the upper zone, and chalcopyrite, zinc blende, and galena, in addition, below the oxidized zone.

The collar of the Takato shaft is 389 ft. above sea level and is sunk on the mother lode to a depth of 1,255 ft. The Ohdate collar is 550 ft. above sea level and is 1,000 ft. deep. The ancient workings near the surface of the ground are so obliterated that the greater part is inaccessible, but the old records show that the upper part of the veins, especially east of "B" fault, was rich in gold and silver, and the bonanza was said to have occurred in a zone between 500 and 800 ft. in thickness. In the middle part and west of "A" fault the bonanza was struck at a depth of between 300 and 500 ft. below the surface, and the thickness averaged 300 ft. The accompanying sketch map gives a general idea as to the relation of the bonanza to the faults and other geological structures.

The present workings are on the 1,000 level and the tenor of ore is $5.50 in gold, and the ratio of values of gold to silver is one to twenty.

Near the surface or in the upper zone lamellar quartz pseudomorphs after calcite can be seen. These seem to indicate the primary occurrence of the calcite in the vein, although it is rarely seen at present at the 300 level, where the vein is enriched with gold and silver. Manganese minerals are rare, and what is supposed to be rhodonite, occurring with sulphides at one place in the Hichisuke vein, and occasional rose quartz may indicate the presence of a trace of manganese in the vein matter.

In the workings at the bottom of Takato shaft, at a depth of 1,255 ft., secondary enrichment of gold is well



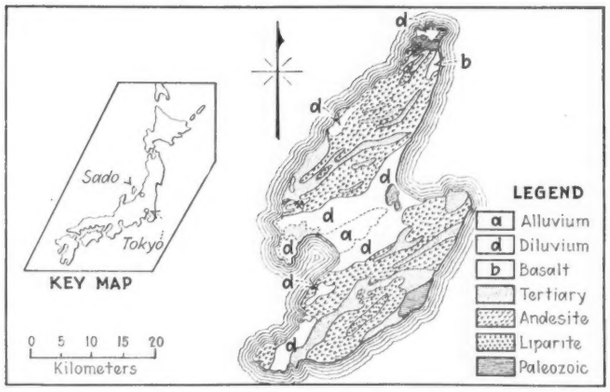
Outcrop of the Takato vein at Sado Gold Mine

illustrated. A specimen consists of milky quartz containing dark bands of sulphides, mostly argentite, and with the protruding particles of electrum embedded in the dark sulphide band. Beautiful yellow and bright gold flakes of secondary nature are deposited on and among them.

A sample of mine water taken 300 ft. below the surface and 900 ft. west of the Ohdate shaft was analyzed in December, 1922, with the result tabulated on page 138.

Substance	Parts per Million	Substance	Parts per Million
Total solids	724.59	Ca	123.39
$CaCO_3$	108.94	Fe and Al	0.46
Free ammonia	trace	SO_3	240.81
SiO_2	8.00	Cl	30.36

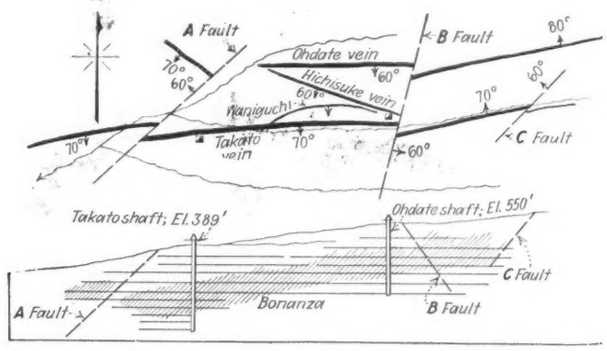
Unfortunately, this was not a complete analysis, but it is interesting to note the high content of chlorine. Furthermore, the abundance of Ca and SO_3 would suggest the action of acid sulphate water upon calcite. Whether the presence of secondary gold in so great



Geologic map of Sado Island

depth as 1,255 ft. is due to the occurrence of much chlorine in the rock cannot be determined from so few data, although it is suggestive. It is generally observed, especially in the Takato workings, that the enriched ore is found immediately above where the calcite begins to appear, and that the impoverishment is noted just below the calcite. The reducing action of the calcite is thus well illustrated.

The enrichment of gold and silver is not only affected by the mineral content of the vein and the country rock, but also by the geological structure of the vein system. As shown in the general section of the orebody, the faults bare important relations to the movement of the underground water.



Sketch showing geological features of the Sado orebody

The bedding structure of the shale and the physical characteristics of the tuff of the Tertiary had undoubtedly some influence upon the formation of the bonanza; but the later faultings and the surface topography must have had greater bearing upon the process of the later enrichment of gold and silver. The record-breaking bonanza shoots in the mother lode were found east of "B" fault, which dips eastward and acted as a dam against the underground water flowing from east to west.

The bonanza orebody in the middle and west of "A" fault pitches westerly as though following the general course of the underground water. A short distance west in the bottom of the Takato shaft progress is slower than elsewhere, due, it is said, to the inflow of the water, which amounts to 17 cu.ft. per minute. Although the distribution of the precious metals is less uniform there than in other places, the vein still is tempting; and the presence of the secondary gold, even of sporadic occurrence, encourages the making of further effort in the drifting along the course of the bonanza in spite of difficulty. The geological conditions also encourage work still farther toward the "A" fault, as the general pitch of the bonanza is from east to west. The enriched part of the orebody there contains $12 in gold and $7 in silver.

The Hichisuke vein has been developed considerably of late. It is quite different from the two great veins already described in that it is high in sulphides, especially of zinc, lead, and copper. Copper assays are as high as 4 per cent, and the vein may be worked for copper ore. The silver content is also high at many places in the vein at a depth of 1,000 ft.

Inventor of Mercury Vapor Process Not Worrying About a Shortage

W. L. R. Emmet, inventor of the mercury vapor process for power generation recently described in the *Mining Journal-Press*, does not believe that efforts in the development of mercury vapor turbines need be slacked on account of a mercury shortage. He says: "The demand for mercury has always been strictly limited, and it is probably not safe to predict positively the consequences of a greatly increased demand. The cost is governed largely by the richness of the ore. Ore of various grades exists in many places, and it only now pays to work the best of it. A well-informed mercury-mine operator has estimated that a maintained price of $2 per lb. would call forth from known sources in the United States enough mercury, if used as we expect, to correspond in plant capacity to the largest yearly output of General Electric turbines. Several other experienced persons have expressed opinions generally agreeing with this view. Unworked deposits are known in Alaska, South America, New Zealand, and elsewhere, and a rise in price will undoubtedly bring much more to light. It is thought, therefore, that we need not slack our efforts for the present through fear of a shortage of mercury."

Announcement was made in a paper presented at the Cleveland convention of the A.S.M.E., that under the direction of Mr. Emmet, Parkman Coffin, of the General Electric Research Laboratory, has made a search for substances which might be used instead of mercury. Among the materials tried were diphenyl, diphenyl ether, and bensophenone. The paper referred to says: "Means might be devised by which sulphur could be used as a thermodynamic fluid. The principal objections to it are that it attacks steel at the temperatures needed, and that it is viscous and a very poor heat conductor even at the temperature of the highest pressure steam which might be used to take heat from it in a condenser."

As a result of this research Mr. Emmet is of the belief that nothing, other than mercury, is ever likely to be used with steam in a binary vapor system such as he has devised.

Useful Operating Ideas

Ventilating an 8,000-ft. Tunnel

By W. R. Lindsay
General Superintendent, Engels Copper Mining Co.

THE method of ventilating an 8,000-ft. tunnel described in the following is not claimed to be original, though I have never seen it used before, nor, as far as I know, have its essential features been described in any publication.

The No. 10 level adit of the Engels mine of the Engels Copper Mining Co. is 8,000 ft. long and will connect with a 490-ft. raise extending to the No. 7 or present lowest working level of the mine. This raise is now up 340 ft. As the speed that could be attained in driving the tunnel and extending the raise is of prime importance, the work was done under a day's-pay-and-bonus system. Ventilation is an important feature that influences the rate of driving.

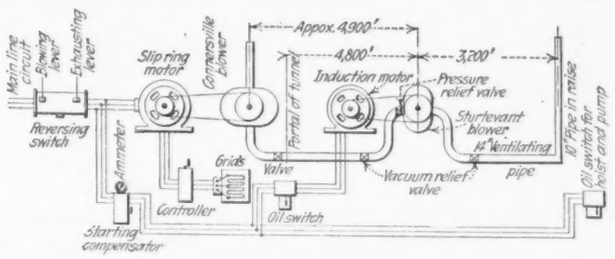
At the time of planning the work, the ventilation problem was thoroughly discussed, owing to the difference of opinions of those to whom it was referred. Consideration of the different views and taking into account the fact that the company had some equipment on hand resulted in the decision to use 14-in., 20-gage galvanized iron pipe as a conduit and positive blowers in series. The pipe was bought knocked down and nested, and was built up at the tunnel in 20-ft. sections with slip joints and riveted ears for wiring together. Muslin and P. & B. paint were used for making the joints airtight. The company had already on hand one Connersville Root-type blower, 12 cu.ft. per revolution; one No. 7 Sturtevant and two 50-hp. motors, which, though oversize, were the only ones available.

The work of driving the tunnel was carried on with two shifts, the day shift going on at 7:30 a.m. and working until 4:30 p.m., coming out for lunch. The drillers came out when the top round was drilled, leaving the muckers to clean up for the bottom round. They returned immediately after finishing and the muckers came out. If the muck was not all cleaned up for the bottom round, the drillers finished it and then set up. The night shift went on at 6:15 p.m. and came off at 3 a.m. Usually each shift blasted its own round, even if some overtime was necessary.

The Connersville blower is installed at the portal of the tunnel and is driven by one of the 50-hp. motors, a slip-ring type. This was started by a controller having a reversing oil switch installed ahead of it. The blower was belted to furnish 2,600 cu.ft. per minute. The 14-in. air pipe was connected to the second blower (No. 7 Sturtevant) at 4,800 ft. from the portal. At the portal a tee was set in the line so that it could be left open during blasting. From the second blower the 14-in. pipe was eventually extended to the end of the tunnel.

The second blower is driven by the other 50-hp. motor (induction type) and belted to deliver the same amount of air as the Connersville. Current is supplied by a three-phase lead-covered, steel-armored cable through a starting compensator at the portal and a reversing oil switch. An oil switch was installed inside at the motor, but the low-voltage release was tied in the running position, as this function was taken care of by the outside compensator.

The 14-in. pipe is protected by two vacuum relief valves and a pressure relief valve, all placed at the second blower, one vacuum relief valve on either side and the pressure relief valve on the outside; that is, between the two blowers. The pressure relief valve has



Diagrammatic sketch of blower connections, No. 10 adit, Engels Copper Mining Co.

not been changed from the original setting at 4 lb., and the vacuum relief valves are held closed by springs under normal operation, but open under any excess vacuum caused by one blower stopping when the other is exhausting from it, or by blasting.

After the raise was started the power cable was extended to the station to supply current for an electric hoist and pump. The pump is a small triplex belted to a motor and supplies about 100 gal. per hour for the drilling machines. A relief valve with adjustable spring is on the pump discharge line, so that the pressure can be increased as the work progresses. A 10-in. galvanized iron pipe extends up the raise for ventilating the manway raise and the ore-transfer raise, which is driven 20 ft. from the manway and connected to it by intermediates at 45- to 55-ft. intervals.

When the tunnel was started and up to the point where the second blower was installed, the Connersville blower provided all of the ventilation. It was used to blow fresh air into the face during the drilling and mucking operations. When the round is spit the blower is stopped and the tee at the portal opened. The compressed-air line is opened at the manifold so as to keep the smoke and gas stirred up and blow them back to the end of the ventilating pipe which terminates from 80 to 100 ft. back from the face. After the last blast the tee at the portal is closed and the blower started exhausting. A few minutes later the compressor is shut down. The smoke and gases are exhausted from the tunnel face between shifts and the blower is then reversed to blow when the next shift goes to work. The same procedure was followed after the installation of the other blower.

While the second blower was being installed, and

before it was connected to the line, the 14-in. pipe had reached a length considerably over 5,000 ft. and the amount of air delivered was estimated to have decreased to one-half of the inlet volume.

The ventilating pipe is back of the compressed-air line on the bottom of the tunnel, which is 8x8 ft. in cross-section above the rails. This position, though more subject to breaks from car wrecks, is not so susceptible to breaks caused by concussion and the air pipe is more easily repaired when broken. During the driving of the entire tunnel from 300 to 400 ft. of pipe was removed owing to damage caused by cars and resulting from rock falls. No pipe was collapsed during the entire work. No time was lost in the heading from lack of ventilation. Several times the ventilating pipe was broken by rock falls, and time was lost due to removing the muck and repairing pipe.

When the raise was started and the pump and hoist were installed, the practice of reversing the blowers could not be continued, as the same circuit operated the pump and hoist motors. Development work was also being extended on the No. 10 level at the same time. This was an additional reason for discontinuing the practice of exhausting. The blowers were therefore operated as pressure blowers, as this gave better ventilation in the raise. The 10-in. pipe in the raise was kept as close to the bulkhead as possible and the compressed-air lines were opened after spitting the rounds, to assist in clearing out the face. So far only one-half shift has been lost in the raise on account of poor ventilation. This was caused by broken muck closing up one of the intermediates so that the gas could not get out of the transfer raise.

A power reading taken on the electric circuit at about the time the raise started gave the following results:

Exhausting:	
Outside blower motor	30 kw.
Inside blower motor	16 kw.
Total	46 kw.
Blowing:	
Outside blower motor	23½ kw.
Inside blower motor	9 kw.
Total	32½ kw.

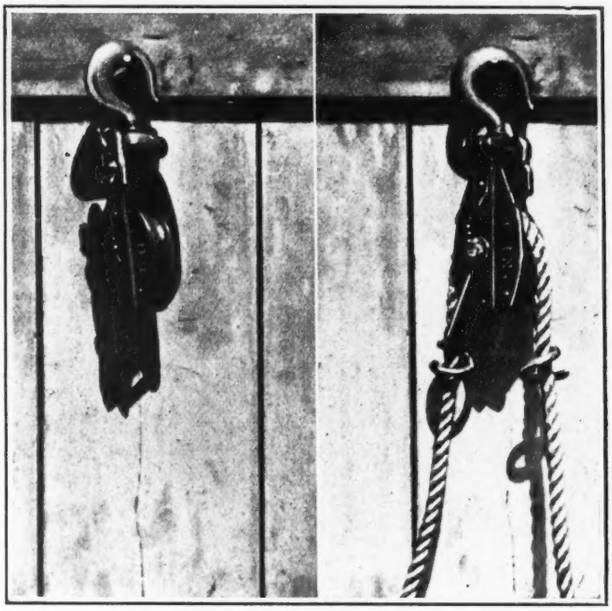
Automatic Mine-Car Coupler

A mine-car coupler, the invention of A. J. Baldwin, of Pikesville, Ky., has recently been perfected. It is designed to save time, eliminate wrecks and to prevent accidents. It cannot accidentally uncouple, but can be quickly and easily released or uncoupled, as shown in the accompanying illustration. When the cars are bumped together they couple automatically and require no other effort. As the coupler holds the cars closer together and there is less bumping of one car against the other, there is a material reduction of the loss from spillage.

Pulley Block Protection

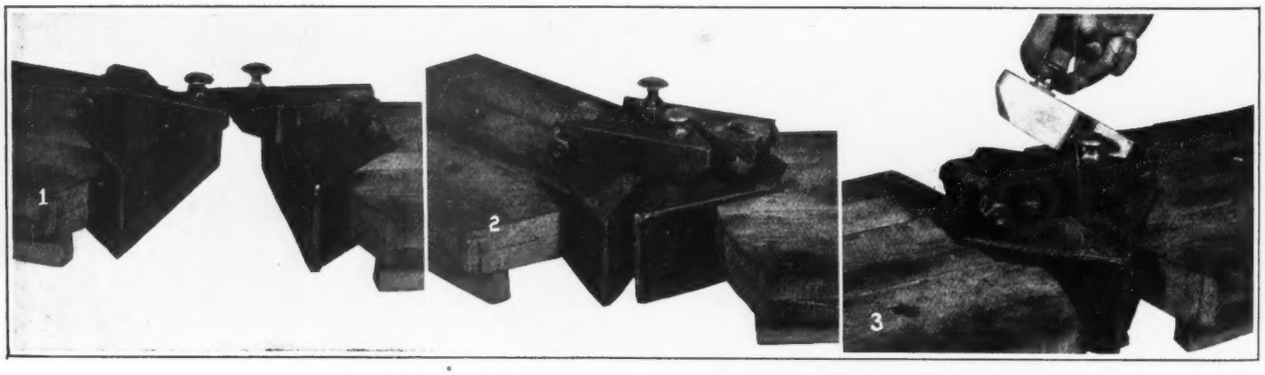
By M. Bowden
Safety Engineer, Elm Orlu Mining Co.

Where pulley blocks are used in the top of a raise that is being driven, the small vertical height available is the cause of numerous accidents. The usual type of block is without protection. To reduce hand accidents to a minimum, guards were designed and placed



Pulley block equipped with iron guard for use in raises

on the pulley block as shown in the accompanying illustration. The guard consists of round iron, one end of which is bent to encircle the rope and the other end of which is forged with an eye for attachment to the block. Two of these guards are attached to the pulley block as shown in the right-hand detail of the accompanying halftone.



Automatic mine-car coupler in use. Model of half size shown
1. About to couple. 2. Coupled on sharp curve. 3. Uncoupling without risk to workman.

Discussion

Reversing the Hammer

THE EDITOR:

Sir—The article entitled "Rod Mills Not an Insurance Against Unnecessary Sliming," by Messrs. Coghill and Anderson, appearing in the June 21 issue of your journal, adds significance to the theoretical reasoning that has recently brought forth cubes as a substitute for, and an improvement upon, spherical balls or cylindrical rods as a grinding medium. Some mention in your columns has lately been made concerning grinding cubes, although no data upon their operating efficiency have as yet been released for publication. The grinding cube as now in use is essentially a true cube, except for slightly rounded or beveled edges and corners.

Consider the ball, the rod, or any grinding medium presenting a spherical or cylindrical impact surface. Ore particles are crushed individually, in the case of balls at least, much as though they were struck by the rounded surface of a ball-pein hammer. The particle caught at the exact point of contact is crushed, and if it be small enough it is pulverized or "slimed" beyond the degree desired. Other ore particles adjacent to the point of contact are spattered radially, to be caught and slimed by some other chance contact. The greater part of the energy of the descending ball may thus be dissipated in a blow of steel on steel, with consequent undue steel consumption. With rods, this same tendency exists, although the spattering is limited to a lateral direction.

Would it not be more logical to reverse the hammer and use the flat face? A number of ore particles are then caught between two *plane* surfaces. The larger particles thus receive the initial force of the blow and hold the surfaces apart until they themselves are crushed and are no longer able to protect the smaller particles. Similar protection is afforded the smaller particles throughout the interstitial space within the cube load, where the cubes slide upon each other in the manner of bucking boards. This protection to the smaller particles is particularly beneficial in grinding sulphide ores, since the sulphides are the most friable constituent and at the same time constitute the part which should not be slimed. Startling substantiation of this reasoning is afforded by the fact that the cubes in wearing down retain their original shape and flat faces until the cube has worn to negligible size.

Three types of impact or contact between cubes are possible: (1) A point contact, obtained when a corner of one cube impinges against any part of an adjacent cube; (2) a line contact, if the edge of a cube so impinges, and (3) a surface-to-surface contact. Either the point or the line contact between moving cubes tends immediately to become a surface-to-surface relation, since that is the position of equilibrium at rest. The point contact affords the least possible area of action, yet it is the most that can ever be attained between balls. The line contact resembles the spatial relation that would exist between rods. The surface-to-surface contact is one which is peculiar to flat-faced polyhedra alone, specifically to cubes.

Not before the actual operating data now being gathered have been rounded out and completed to cover the variable conditions of a relatively long period would it be advisable to make the figures public. Until the proof has become indisputable, preliminary or incomplete data would serve merely to arouse controversy.

In the meantime, however, why not think about reversing the hammer? E. H. ROSE.

Nacozari, Sonora, Mexico.

A Suggestion as to Grinding Media

THE EDITOR:

Sir—In respect to shape of grinding media for rod or ball mills if there is a tendency for the rod, ball, or cube to retain its original shape and the maximum contact between the surfaces is the object sought, then there can be no doubt that the shape should be hexagonal and not cubical as Mr. MacDonald is using. This can be easily verified by drawing the three different shapes and measuring the possible contact surfaces. Also, the greatest number of rods or balls contained in a given space will be those hexagonal in shape. I hope you will publish this idea simply to prevent some one from making it the subject of a patent. I have no data on the subject, but hope soon to have some, as I am now experimenting along these lines. ALGERNON DEL MAR.

Victorville, Calif.

An "Open" Gold Market

THE EDITOR:

Sir—With reference to your editorial "An 'Open' Gold Market" in your issue of July 5, in which you say "The gold miners feel that if they can sell their output directly to the manufacturer they will be able to obtain a higher price than by disposing of it to the government," and that "The only question, from our point of view, is whether the remedy is workable," I beg leave to submit the following to show why the proposed remedy is *not* workable:

In the case in hand, the gold producers, or most of them, seem to think, very erroneously, that their troubles are different from those of other metal producers, because Uncle Sam has fixed what they call an "arbitrary price" for their product, and which they also think is not high enough to satisfy them, in these times. The real question at issue, therefore, is What is it that actually determines the true "price" of gold?

The prices of all commodities and services are expressed in terms of gold, and, conversely, the price of gold is expressed in terms of all other commodities, and *not* in terms of itself.

Economists know very well that all values that may be expressed in standard money are relative—that is, comparative—and that the business of exchanging commodities requires a standard in terms of which all monetary values may be expressed, and that standard

which has been chosen by the nations of the world, when made up into pieces that are called coins, is the only real standard money. Substitutes of various kinds are used in the place of standard money; but, technically, the only real money of today in the United States is standard gold coin.

Many persons will object to that statement, and will ask "What about silver coins and paper bills and even nickels and cents: aren't they money too?" And the answer is that in a popular sense, they are *forms* of money, but they are *not* real money; that is, standard money in its true sense. An explanation in technical detail of the reason why this is true cannot be given here, as it requires far too much space.

Since gold coin is the standard, in terms of which the prices of all other commodities are quoted in the United States, and since all "prices" are relative—comparative—there must necessarily be at least *two* different commodities to afford a *comparison*, in order to obtain any idea whatsoever of their *relative* exchange values.

The fine gold in the gold bullion that you took to the mint has precisely the same gross exchange value that have the coins that are returned to you in its place. You have simply taken your gold to the mint in the form of a relatively large ingot or bar of a certain fineness and have received it back again in the form of smaller ingots or bars; perhaps of another degree of purity, but all of your pure gold has been returned to you. Have you really sold your gold to Uncle Sam at a "price," or have you, instead, simply taken it to the mint to have it made up, without cost to you, into convenient form for use, and received it back again in such form as will enable you to sell it to others for commodities, at convenient times and places? Of course, if you don't want to lug around the actual coin, and if you have no safe and convenient place in which to store it, you can take it to a bank and deposit it and receive credit for it, and in turn draw out substitutes for it in forms of so-called "paper money," or "subsidiary silver money," or nickels or cents—any or all of them; or you can give checks to others—aggregating altogether the weight of fine gold in the coins you deposited, at the rate of one "dollar" for each 23.22 gr. of fine gold in such deposit. But you have not actually *sold* your gold bar in its entirety until you have withdrawn all of your deposit account and have exchanged it for commodities—and services, perhaps—and that which you have received in such exchange is really the true "price" at which you have *sold* your gold.

The same line of reasoning holds good if you sell your bullion bar to a smelting company, for example, and receive a good check for it—or the mint will give you a good check for it, which in all cases calls for the same weight of fine gold as was contained in your bullion bar. But don't overlook the fact that you *sell* your gold for the things you *buy* with it.

Our so-called "paper money" is all convertible into gold at its face or nominal value. It would seem, therefore, that a jeweler or other fabricator of gold would have to be demented before he would swap say $25 in "bills" for a fine ounce of a gold producer's gold. Such producer could, in that event, take $20 in such bills and swap them with a dealer in foreign coin for another ounce, practically, of gold; and then take that back to the jeweler and swap it for another $25 in bills, clearing 25 per cent on each transaction as long as demented (?) jewelers lasted! Or, perhaps, jewelers and other fabricators of gold have *other kinds of dollars* to swap for your gold? Have they?

The exchange value or purchasing power of the dollar (namely, 23.22 gr. of fine gold) is universally known, and when that *name* is used in place of that particular weight or quantity of a certain metal in which a commodity is "priced," the exchange value of such commodity becomes apparent at once; because the *purchasing power* of the dollar is very well known, though the populace, as a rule, hasn't the faintest notion as to what *the dollar* is, actually.

In conclusion, it may be said, incidentally, that our government could fix upon 23.22 gr. of fine silver as our standard unit of value and name it "the dollar." In which event silver would become worth $20.67 per oz. in terms of such silver dollars; that is to say, our government has the power to make silver worth $20.67183 per oz. in terms of dollars of 23.22 gr. of silver. But if the commerce of the world, which is really the only authority that has the power to determine the relative exchange values of silver and gold, should determine at any time that such relative value—ratio—of silver to gold shall be as 31 is to 1, for example, then the ounce, or 480 gr., of silver, which would be worth $20.67 in terms of our new silver dollars, would be actually worth only 15.5 gr. of gold, or 66⅔ cents in terms of our present gold dollar, and that is substantially the price of silver today.

But, of course, if the nations of Europe should resume the use of silver for monetary purposes, its exchange value as compared with gold would increase very materially. W. DE L. BENEDICT.

New York City.

Prospecting in Mexico

THE EDITOR:

Sir—Let us take another trip prospecting via your Journal to Mexico. Some miners have been stuffed with "buck fever," and are always asking, "Is it safe to mine in Old Mexico." I will say "yes." There is more crime and outlawry committed every twenty-four hours in our cities than there is in the whole Republic of Mexico in one year. I cannot explain all the traits and customs of our southern neighbors, as I am no expert on human nature. I will state facts as I see them.

When we cross the international line and visit the custom house for passes or favors it is well to remember our mothers' teaching to be courteous at all times. Always take good letters of introduction with you, and have some Mexican Consul in America vouch for you. The Mexican customs officer will always recognize these papers. If you neglect this part, the officer will let the fact be known, that Mexico is running no free soup kitchen for American loafers, and when you receive a prospector's permit (ninety days is the limit) don't drag this Mexican eagle, which is stamped on all government papers, around in the rain and mud. You are requested to return all passes to the office where they are issued, before the time set runs out, and Mr. Officer wants you to show your respect by keeping all official papers clean. Some prospectors doll up like a U. S. naval cruiser. This looks to some people like a challenge.

Pay your taxes, dues, etc. Treat the peon and upper class with the same respect that you demand for yourself, and you will find that Mexico is no Wild West show.

Kingman, Ariz. E. B. FOSTER.

The Balancing Feature of Mills

THE EDITOR:

Sir—Many "balanced" machines, including mills, have appeared to date. Saving power used in crushing, however, is rather a novel pretense for them. There is much room for honest difference of opinion about Rittinger's law, Kick's law, and the advantages of various machines and methods: but divining rods, 200 per cent extraction, perpetual motion, and saving power by balancing segments are not on the free list.

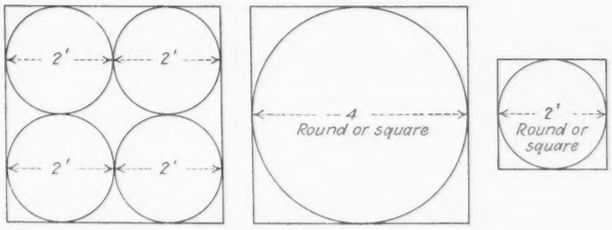
If we take a 2-ft. mill of a given length, the maximum distance of drop of a ball or rod is less than 2 ft. The maximum possible number of drops of any ball or rod is two per revolution if we omit the time occupied while actually dropping and assume the maximum drop. If we take a 4-ft. mill of the same length as the other, the maximum distance of drop is double that of the 2-ft. mill. The number of drops of any ball or rod is still two as a maximum for each revolution as before. Hence for each revolution at the proper speed for each mill, the 4-ft. mill will have four times the weight of grinding medium and twice the distance of drop of the 2-ft. mill. The power required is eight times, and if both are equally suitable, the output is eight times as great per revolution.

Now, if we bind four of the 2-ft. mills to a common shaft, we have the same maximum drop as the regular 2-ft. mill, the same number of drops per ball or rod per revolution, four times the weight of crushing medium and four times the power and output per revolution, at a modified suitable speed, as one unit of the same diameter and length. It makes no difference if the four mills are in a straight line or if they are segments. This principle is the same regardless of the shape of the mill. It is only the relative movement of the crushing medium that counts, and not the balancing of one segment against another: otherwise, perpetual motion would be an accomplished fact. Operating mills on Ferris wheels, seesaws, or balanced elevators will not overcome the necessity of using at least one horsepower to elevate 33,000 lb. 1 ft. per minute.

The maximum starting requirement of a ball mill is when the mill is loaded half full, and the greatest possible position of unbalance is with the entire load on one side. In a 2-ft. mill the center of gravity of the load would be roughly 5 in. from the center of the mill under these conditions. In a 4-ft. mill the center of gravity is exactly twice as far from the center of the mill. The 4-ft. mill takes eight times the power per revolution and does eight times the work per revolution of the 2-ft. mill of the same length, both for starting and running. The load is four times as heavy at twice the distance from the center.

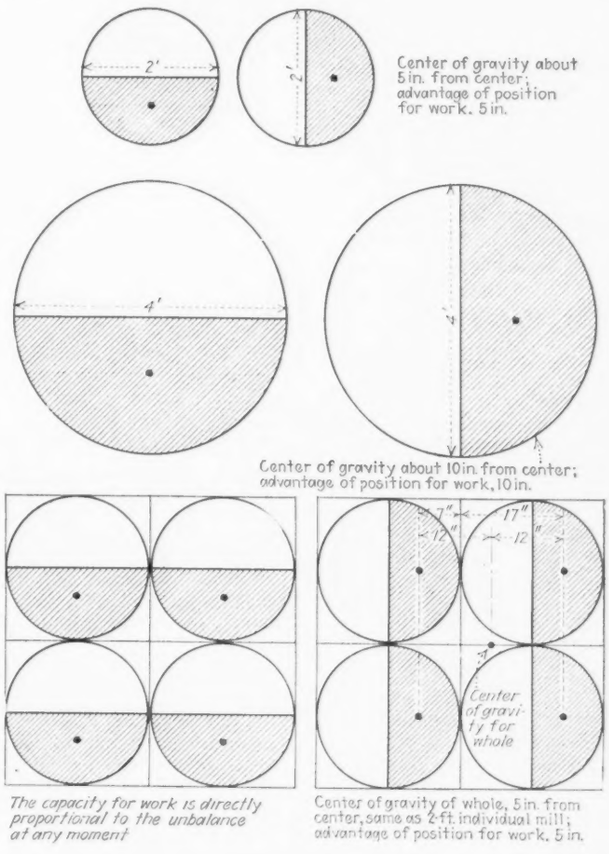
Four 2-ft. mills have exactly four times the weight of load at exactly the same distance from the center and the starting and running requirements are four times that of one mill. You do not gain a single milligram by tying the four together. The relation of starting requirements and power at the motor to the capacity is exactly the same with the misnamed balance mill and the unjustly called unbalanced mill. The latter uses a steady, continuous amount of power, as does the former if it is as illustrated. If the segmental mill is not of round section, the power requirement is an irregular amount in surges. A mill of three segments has nine surges altogether (three surges each of three varying powers) per revolution.

If starting requirement was the only thing sought, it would be better to have four small mills started separately than to have them tied into a "balanced" mill, where they all start at once. If it takes twice as much to start a mill as to keep it going, we have the following facts: If it takes 2 hp. to operate one



2-ft. unit and 4 hp. to start, it will take 16 hp. to start the "balanced" mill, whereas if the four individual units are started separately the first one takes 4 hp. and this goes down to two; then the second unit causes a momentary requirement of four more, or 6 hp., the third one 8 hp., and the fourth 10 hp., thus showing an advantage for the individual units.

A single mill four times as long as the so-called balanced mill would require exactly the same power to start as the latter. Any variation from the round mill will produce irregularity. There is nothing to "balance" unless you unbalance it first.


2'
2'
Center of gravity about 5 in. from center; advantage of position for work, 5 in.
4'
4'
Center of gravity about 10 in. from center; advantage of position for work, 10 in.
7"
12"
17"
12"
Center of gravity for whole
The capacity for work is directly proportional to the unbalance at any moment
Center of gravity of whole, 5 in. from center, same as 2-ft. individual mill; advantage of position for work, 5 in.

In the illustration you will notice that where a portion of the charge is moved to the left for "balancing" purposes, the rest of the charge is just that much farther toward the right, neither more nor less.

Los Angeles, Calif. JOHN HERMAN.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

THE Mexican Government has suspended the decree whereby exporters of products containing gold were obliged to reimport an equivalent amount in the form of gold coins or fine bullion. Mine operators protested vigorously.

Ratification is announced of the agreement whereby the Tonopah Midway and Tonopah Divide companies are merged.

A 1,700-ft. vertical diamond-drill hole will be driven at the Cresson mine, at Cripple Creek, to carry the electric power cable underground.

The Flowery Comstock cyanide plant, situated near Virginia City, Nev., is ready to run.

Creditors of the British-America Nickel Co., operating in the Sudbury district, have asked that the concern be put in the hands of a receiver.

Unshaken faith in the future of the copper-mining industry is shown by operators in Michigan, who continue with large construction programs.

The Atlas Mining Co., under the management of W. Earl Greenough, has started an important development project in the Coeur d'Alene district, in Idaho.

Greater attention to potash, phosphate, and arsenic is planned by the Mineral Resources Division of the U. S. Geological Survey.

Net earnings amounting to $236,783 are reported by the Portland Gold Mining Co., of Cripple Creek for the first half of 1924.

According to an official of the Day interests, the Stratton mine today looks better than the Hercules did in the same stage of development. The Days now control both properties.

Stratton Mine Looks Better Than Hercules Did at Same Age

So Says Day Official Regarding New Coeur d'Alene Producer—Threatened Litigation Avoided

At a special meeting of stockholders of the Stratton Mines Co. in Wallace, Idaho, the agreement entered into by the directors of the company with the Coeur d'Alene Mining & Smelting Co. for the settlement of threatened litigation involving the ownership of certain ground covering the Stratton vein was unanimously approved. Under the terms of the settlement, the Coeur d'Alene Mining & Smelting Co. will receive 150,000 shares of Stratton stock. To make this payment the stockholders authorized an increase of the capital stock of the Stratton company to the extent of 500,000 shares, making the total capitalization 2,000,000 shares.

The Stratton continues to hold its place as one of the most remarkable discoveries in the history of the Coeur d'Alene district. The strike was made last September, and up to date the company has shipped ten carloads of ore which netted around $2,500 per car, the returns covering all expense of development and leaving a substantial balance in the bank. The oreshoot has been followed practically without a break for 350 ft., and the showing in the face is now better than at any time since the strike was made. At this writing there is said to be 30 in. of shipping ore in the face of the drift as well as 4 or 5 ft. of milling ore. Control of Stratton is now held by the Day interests. An official is quoted as saying that the showing at the Stratton is better than that on the Hercules at a corresponding stage of development. The Hercules is one of the big Coeur d'Alene mines.

Flowery Comstock Cyanide Plant Ready To Go

THE 200-ton cyanide plant of the Flowery Comstock Mines Co., in Six Mile Canyon, near Virginia City, Nev., is completed and is being given a trial run. The plant will be operating at capacity before the end of July provided no unexpected difficulties arise.

The mine shows a probable tonnage of 130,000 tons of $7 gold ore, on which laboratory tests indictating an extraction of 98 per cent can be obtained.

This Dump Pays

Lessees on the Orpha May dump, at Cripple Creek, Colo., are shipping about 100 tons of ore daily to the Golden Cycle mill, at Colorado Springs, for which they are receiving about $4.50 per ton at the mill. It is expected that shipments will be increased to 200 tons daily.

Tonopah Midway and Tonopah Divide Merge in Nevada

Plan to Use Divide Cash to Develop Midway Ground—New Hoist Will Have 3,000-Ft. Range

At a stockholders' meeting of the Tonopah Midway Mining Co., held in Tonopah on July 12, the proposal of the Tonopah Divide Mining Co. to take over the Midway property for a consideration of 194,049 shares of Tonopah Divide stock was accepted. Stockholders in the Midway company will receive one share of Tonopah Divide stock for every seven shares of Midway stock held by them. More than 900,000 shares of Midway stock was represented at the meeting, and the vote was unanimous for the exchange.

The Tonopah Divide company has a substantial treasury, with over $300,000 in cash or quick assets, and is therefore able to finance deep work in the Midway mine. It is reported that a new hoist will be installed at the Midway shaft, suitable for sinking to a depth of 3,000 ft. Actual development plans have not as yet been given out, but it is understood that as soon as suitable machinery can be installed an energetic campaign of development is to be started. The purpose of this deep work is to develop the easterly extensions of the large and rich veins now being mined in the Tonopah Extension at a depth of more than 2,000 ft. This is very important work and results will be watched keenly.

Mesabi "Independents" Ship Good Tonnage of Iron Ore

New Operations Partly Offset Curtailment at Some Properties—Inland Steel Co. Reaches Ore in New Shaft

Although there has been a slacking in mining operations on the Mesabi iron range, in Minnesota, the outlook is still fair. The docks of the Great Northern Railroad Co., which handles a large proportion of the ore from the independent operators on the range, show a slight gain in shipments up to July 1 for the season of 1924 in comparison with those of 1923. Total shipments from all docks at the head of the Lakes show a decrease of approximately 1,250,000 tons for this season, with total shipments of 14,827,127 tons forwarded to the lower docks as of July 1.

The M. A. Hanna Co. has relinquished its lease on the Fay mine, near Virginia, and the Frantz mine, near Buhl. In the case of the Fay mine there is little ore remaining which would warrant mining under present conditions. The orebody has been exhausted at the Frantz mine. The other properties of this company are working under normal conditions. In other localities certain operations have been curtailed, but this curtailment has been partly offset by new enterprises.

Butler Brothers are making preparations for the stripping of a property adjacent to their present holdings at Nashwauk. A new mine has been added to the shipping list in the Mary Ellen, near Biwabik, where the ore is concentrated before shipment.

The Inland Steel Co. is sinking a new shaft at its Laura mine, near Hibbing, and has just reached the ore. The Bennett Mining Co., at Nashwauk, has outlined a busy season of work. Besides the large stripping operations which are now in progress, there is considerable underground work incidental to the connecting of the two underground shafts. On completion of the connecting drift to the new No. 2 shaft all ore will then be handled through this shaft, and No. 1 will be abandoned. New construction work includes a locomotive shed and repair shop and a new change house.

Washington Magnesite Industry Picks Up; New Plant Equipped

The magnesite industry in Stevens County, Wash., is gradually increasing its output as a consequence of the increased demand for plastic magnesite, which is used extensively in building operations.

A new $200,000 company was recently formed by Spokane business men to be known as the Spokane Plastic Magnesite Co. A site has been obtained, and the installation of the latest type of calcining furnaces and modern machinery is planned. The new company has contracted with the Northwest Magnesite Co. at Chewelah, for 5,000 tons of crude magnesite per month, and will soon be in a position to market its product. It expects to make a high-grade calcine.

Cresson Will Sink 1,700-Ft. Drill Hole for Power Cable

The Cresson Consolidated company, operating at Cripple Creek, Colo., has let a contract for a 3-in. diamond-drill hole from the surface to the 17th level of its gold mine for the purpose of carrying a power cable which supplies energy to the pumps. The cable at present is suspended in one corner of the manway in the shaft, but is considered dangerous and uncertain, with the possibility of interruption which would shut down the pumps. Below the 17th level the shaft is of three compartments, in which the cables can be installed with perfect safety.

The 1,700-ft. drill hole is the longest drill hole ever attempted in the district.

The shaft has now reached the 20th level, but is being driven an additional 75 ft. to provide a sump. The early season flow of water is gradually decreasing in the district.

Inspiration Hastens Work of Leaching Plant Construction

Inspiration Consolidated Copper Co. has issued a call for bids on a contract for excavating approximately 125,000 cu.yd. at the site of the new leaching plant at Inspiration, Ariz. Contractors have been asked to rush their estimates, and the letting of the job will be done as soon as possible. Other contracts for the construction of the huge plant will be placed immediately and the work will be rushed. The new unit will be designed for treating 7,500 tons per day, and the cost is estimated to be about $6,000,000.

Portland Netted $236,783 During First Half of 1924

Net earnings of the Portland Gold Mining Co., operating at Victor, in the Cripple Creek district of Colorado, for the six months ended June 30, were $236,783 according to a recent announcement. The entire indebtedness of the company has been paid and in addition the company has, during this period, bought and paid for additional mine equipment costing $46,048.65.

Since the first of the year the main working shaft has been sunk 154½ ft., and it is expected it will be completed to the 3,000 level within the next four months. This will permit the opening of two additional levels, 135 ft. below the productive levels now being worked.

Leadville Mines Co. Increases Ore Reserves Toward West

Officials of the Leadville Mines Co., operating the property at Gerlach, Nev., report that a substantial increase in ore reserves has been made through developments to the west on the 600 level. The mill is operating to capacity, treating 60 tons of ore per day. There has been a shortage of water, but this has been taken care of by the installation of two 28-ft. thickeners.

Future development work planned includes the sinking of the main shaft another hundred feet, and hanging-wall and footwall crosscuts from the main vein drifts in search for new veins.

Michigan Copper Producers Show Unshaken Faith in the Future

Calumet & Hecla Continues Big Construction Program—Others Follow Suit—Object, Low Operating Costs

Calumet & Hecla Consolidated's decision to proceed with the construction of a railroad, 9 miles long, between the Ahmeek mine and Ahmeek stamp mill, reveals the confidence in the future of the Michigan copper district. It is additional evidence of determination on the part of the Michigan producers to reduce production costs to absolute minimum. In line with this plan, Calumet & Hecla Consolidated has three other projects under way—namely, the Tamarack reclamation plant, which will extract copper from waste conglomerate sands at a cost of approximately 6c. per lb.; a haulage tunnel over 8,000 ft. long, connecting the conglomerate shafts at a depth of 8,100 ft., which will reduce the cost of mining at great depth; and a coal-pulverizing plant at the smelter, which should reduce the smelter fuel cost at least 30 per cent. Installation of electric pumps in Tamarack No. 5 shaft, in which pumping for the conglomerate department will be centralized, and mining of Kearsarge lode ground through fewer shafts also will serve to lessen costs through improved operating efficiency.

Quincy is effecting economies by operating stamp heads in its mill by an exhaust steam turbo-generator plant, use of a method whereby smelter slag can be treated successfully in the reverberatory furnaces instead of in a cupola furnace, and time- and labor-saving devices in casting and storage of the finished product.

Mohawk will effect a notable saving in copper recovery through installation of regrinding units in its stamp mill, one of four stamp heads having been equipped to date. The low price of copper has prompted operating companies to resort to every possible means of reducing costs, but no substantial profits will be realized until metal advances two or more cents per pound.

Receiver Asked for British-America Nickel Co.

Receivership for the British-America Nickel Co., operating a mine and smelter in the Sudbury district in Ontario, and sale of its assets, is asked in Courts at Toronto by the National Trust Co., holder of a mortgage trust deed securing $6,000,000 first income bonds. The action has been taken, it is understood, by a large body of Norwegian shareholders and bondholders whose par holdings are said to exceed $15,000,000.

The company is capitalized at $20,000,000 and has $22,500,000 bonds outstanding, of which the British Government holds $14,000,000 stock and $3,000,000 bonds. During the war the British Government secured the output of a Norwegian nickel plant and in return aided the Norwegians to finance the development of the British-America company at Sudbury.

Atlas Mining Co. Starts Development in Coeur d'Alene

Will Extend Horseshoe Tunnel to Carbonate Hill Vein—Good Showing Will Be Tested at Depth—Mine Near Mullan

Active work has just been started by the newly organized Atlas Mining Co., which has consolidated four groups of claims in the Coeur d'Alene district of Idaho. W. Earl Greenough is in charge of operations. Associated with him are: D. A. Callahan, of the Callahan Zinc-Lead Co.; Wayne Johnson, of New York, and James F. McCarthy, president and manager of the Hecla Mining Co. The properties controlled by the Atlas company are: The Carbonate Hill, Idaho Giant, Horseshoe, and Boulder Creek, embracing an area of 600 acres situated in promising territory just above Mullan. Good showings of ore have been exposed on the Carbonate Hill, Idaho Giant, and Boulder Creek properties.

The work now under way is the extension of the Horseshoe tunnel, which it is estimated will cut the Carbonate Hill vein at approximately 3,500 ft. from present face. The tunnel now is in about 1,100 ft. This will cut the vein at a depth of 700 ft. below the Carbonate Hill tunnel.

Further extension of the Horseshoe tunnel will reach the Idaho Giant vein in about 1,500 ft. and at a depth of 1,700 ft. below the present tunnel, while its continuance a short distance will cut the Boulder Creek vein at practically the same depth.

Some years ago a 90-ft. oreshoot was exposed on the Carbonate Hill shaft level 400 ft. below the tunnel. The portal of the Horseshoe tunnel is near the railroad, almost opposite the National mill. It is possible that some arrangement will be made for the lease or purchase of the mill if good ore is developed in quantity. The project is being watched with unusual interest in the Coeur d'Alene.

Mohawk Concentrates Efforts at Older Shafts

The Mohawk Mining Co., in the Michigan copper district, has temporarily suspended exploratory work on lands west of Wolverine. Meanwhile, efforts will be directed toward enlarging the underground force in the Mohawk shafts, increasing production, and reducing cost per pound of copper. Results of the exploratory operations to date are satisfactory. A sufficient showing of copper has been revealed to warrant the continuation of the work.

A series of test pits were put down in the Pewabic bed and some work also was done on the Allouez conglomerate. The copper showing in the Pewabic is considered very good, and some values also were found in the Allouez on the footwall side of the formation.

The first month's test of the regrinding unit installed in the Mohawk stamp mill was most satisfactory. Working entirely on Wolverine tailings, a recovery of one pound of copper per ton was obtained.

Lake Shore Mill Increasing Tonnage Handled

At the Lake Shore mine, in the Kirkland Lake district of Ontario, the enlarged mill is steadily being tuned up. The tonnage is now 125 tons a day, and this will be gradually brought up to the objective of 300 tons a day. So far there has been no change in the grade of the ore milled. The former mill had a capacity of about 60 tons a day and the ore averaged about $25 a ton.

Professor-Geologist Aids Prospector in State of Washington

As an aid to the prospector and properties undergoing development Olaf P. Jenkins, professor of geology at Washington State College, is making a geological survey of the lead deposits of the Metaline district, in Pend Oreille County and the Northport district of Stevens County, Wash. The results of the survey so far have been the discovery of geological features which likely will serve as a basis for more scientific prospecting in the Metaline district.

Structural conditions in the rock formation and faulting are distinctly related to ore deposition in a manner that can be discerned definitely, according to Professor Jenkins, and the miners and prospectors in the district are anxiously awaiting the reports of his investigation.

Colorado Metal Production in 1923 Totaled $18,170,647

The total value of gold, silver, copper, lead, and zinc produced in Colorado in 1923 was $18,170,647, according to official figures by the U. S. Geological Survey.

Through its large production of gold, Teller County, which includes Cripple Creek, led all other counties of the state. It produced 195,866 oz. of gold, worth $4,048,906. Silver brought the Teller County total to $4,067,468.

San Miguel County led in silver production, with 1,982,007 oz. valued at $1,625,246, and in copper with 1,625,246 lb., valued at $211,281.98. It was second as a gold producer, with 66,100 oz. valued at $1,366,404. The Tomboy and Smuggler Union mines were the chief contributors.

San Juan County was the leading lead producer with 10,378,156 lb., valued at $726,471. The Sunnyside mine was the leading producer.

Eagle County leads in zinc, producing 23,600,000 lb. of that metal, valued at $1,604,800.

Mill Near Silverton Burns

The milling plant of the Crouse-Tremain Co., situated on the Animas River, about three miles above Silverton, Colo., was completely destroyed by fire on the afternoon of July 9. It is thought that the fire originated from a bolt of lightning. The mill represented an outlay of approximately $100,000, but had been inactive for a considerable period prior to its destruction.

New Method for Using Rock Asphalt in Roads

Test Road Constructed in Utah—Former Attempts Have Met Indifferent Success—Economical Scheme Necessary

Experiments in the use of Utah rock asphalt in road building are being made near Vernal, Utah, where a strip about a mile long is being built of this material. The road is part of a federal-aid project and is a link in a transcontinental route. During the winter 500 tons of rock asphalt was brought from deposits near Vernal. The material is placed in shallow vats, of which there are six connected with the steam rack of a neighboring cannery. The large lumps are reduced by means of steam heat until they become "live"; these are then broken still further by means of a hammer, to three or four inches, and are then further heated by means of fires placed under the vats.

Crushed rock, such as is being used for the main body of the road, forms a base for the experimental road. After this has been rolled with a 10-ton roller, a thin coat of prepared asphalt is placed on top. This is followed by a layer of gravel, maximum 1 in. pieces, and spread to a depth of 1½ in. More of the mixture from the vats is then placed on top of the gravel, and raked and rolled into it. The mixture from the vats is about 12 per cent asphalt, and mixed with the fines in the gravel it is reduced to about 9 per cent, which is said to be the best mix for this part of the road. A final and somewhat richer layer of asphalt is added, and the road given a smooth surface.

Other methods of utilizing rock asphalt for roads in Utah have been tried, but these have not brought the material up to requirements. It is expected that the method here outlined will give good results. Utah has several deposits of rock asphalt, and if it can be demonstrated that a satisfactory road can be built cheaply from this material, its use will undoubtedly be extended to other localities.

Forest Fires Destroy Nabob Mill, in Coeur d'Alene

Forest fires on Pine Creek, in the Coeur d'Alene district, Idaho, have destroyed much property belonging to the Nabob Lead-Silver Co., including the mill of 150 tons' capacity, which only recently had been placed in steady operation; also, all other equipment in connection with the mill, including the company office and the homes of employees. It is a hard blow to the Nabob, as the company has long been carrying a heavy financial load. The fire also destroyed the compressor plant and all other surface equipment and improvements of the Douglas Mining Co., which has been inactive for several years.

The conflagration was put in check before reaching the Constitution mine and mill, though not before it had destroyed a large body of excellent timber as well as surface improvements in connection with smaller mining operations that lay in its path of destruction.

Barbecue Marks Starting of New Plant at Crushton, Calif.

Will Crush and Wash 5,000 Tons per Ten-Hour Day—Gravity Plant —Gyratory Crushers

On June 28, the new crushing, screening, and sand-washing plant of the Union Rock Co. at Crushton, near Los Angeles, was formally started, the occasion being marked by a barbecue at which about 500 were present. The plant is an example of the application of new ideas and equipment throughout and will have a capacity of about 5,000 tons of product per ten hours. All commercial sizes of crushed rock and washed sand will be made.

Several interesting features are noticeable.

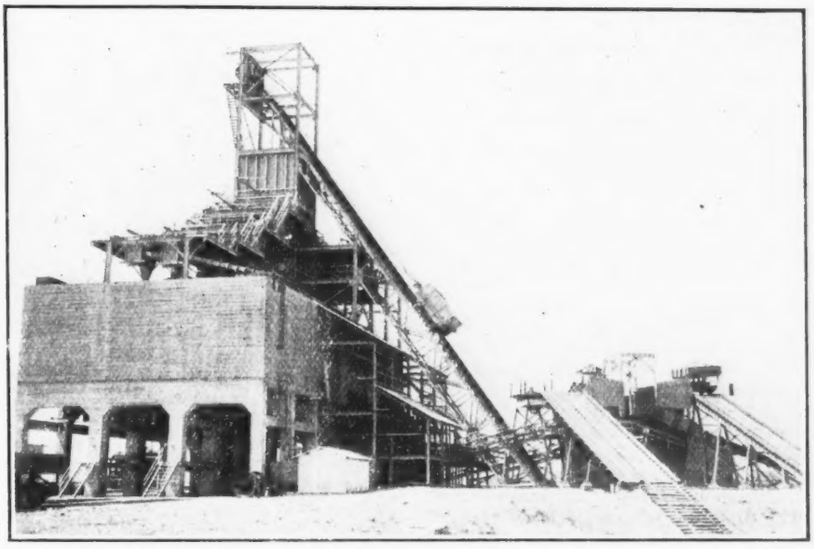
The raw product, from an almost inexhaustible supply of river-bed material, is mined by steam shovel and delivered to cars, which are hauled by a motor-driven hoist. The contents are discharged over grizzlies to the primary crusher. No bucket elevators are used. The crushed material is hauled in one of two large skips to the top of the plant, where it is divided for wet and dry treatment, respectively. Several types and sizes of trommels and shaking screens are used prior and subsequent to secondary crushing, for which gyratory machines have been installed throughout. The sand is washed and separated in automatically operated cones, and the various products are delivered to concrete storage bins, arranged over the railroad tracks. Steel and concrete has been used in the construction of the plant.

Mines Employ More Than Half of Arizona's Workers

According to figures recently issued by the Arizona Industrial Congress, twenty-two operating copper and gold mines and smelters situated in seven counties of Arizona employ 18,500 men and have an annual payroll of $29,000,000. If mines in the development stage are included, it is estimated that the total annual payroll would be in excess of $30,000,000, and there are more than 20,000 employees. More men are employed in the mining industry in Arizona than in all the manufacturing industries and on the farms added together, it is said. If the great number of people who are dependent indirectly upon the mines payroll for their livelihood are considered, in addition to the workers at the mines, the value to the State of Arizona of the prosperity of the industry can be readily appreciated.

Drive Crosscut to Develop Frog-Pond Property

Officials of the Montana Prince Mining Co. have been inspecting their property at Frog-Pond, 10 miles southwest of Moose Lake, in Granite County, Mont. A 600-ft. crosscut tunnel is being driven under the supervision of E. R. Sheppard. It is now about half finished. A new road, 5 miles long, is being built jointly by the state and the county, and it will be a great help to the company.



Screening and sand-washing plant of the Union Rock Co. at Crushton, Calif.

News from Washington

By PAUL WOOTON
Special Correspondent

Miss Opportunities in Foreign Mining Enterprise

American Mining Interests Backward, Think Economists—Should Utilize Foreign Mineral Supplies—Great Britain Has Progressive Policy in This Regard

BECAUSE the United States has absorbed more of the world's gold than is good for this country or the other countries, and as we have accepted credit documents in a greater aggregate than is prudent, the time has come, in the opinion of many students of the situation, in Washington, when we must begin to take more of the world's commodities. In that connection it is pointed out that the United States is in a position to use to advantage larger supplies of mineral raw materials. Much of the same benefit to all concerned would follow were American interests to undertake more mining operations abroad.

Twice within a year, for instance, American capital has had an opportunity to take over the operation of the largest quicksilver producers. The Spanish Government put up for renewal the lease on the Almaden mine, but there were no American bidders. Strangely enough, an opportunity was presented soon thereafter to operate the Istria mine, the second largest producer of quicksilver, which is situated in that part of Italy taken over from Austria as a result of the war. The disposal of the lease was intrusted to an American mining engineer. His efforts to dispose of it in the United States were futile. He had little difficulty, however, when he presented the proposition to British financial interests. One of the thoughts expressed in that connection is that the existing duty on quicksilver, which is having the effect of exhausting our meager resources, which should be safeguarded in the interest of national defense, should be repealed and American consumers allowed to draw their supplies from sources abroad which should be controlled by American enterprise.

In view of the fact that this question is certain to come up for wide discussion during the Presidential campaign, the thought also is expressed that we would do more export business were the individual companies engaged in those trades to become importers as well. There is, for instance, a powerful American interest engaged in a promising branch of export trade with the Dutch. That interest is in a particularly advantageous position to enter into an arrangement looking to the increased consumption in this country of Banka tin. The Dutch recently have been having difficulties in finding capital for the continuance of some of the Banka tin-mining operations. Some such arrangements as these must be resorted to if the bad economic situation in which the world finds itself is remedied.

In view of the fact that Great Britain's foreign investments proved to be one of the Empire's great mainstays during its greatest emergency, there is a general disposition on the part of those in a position to scrutinize the distant horizon to urge a greater investment of American capital abroad, particularly in mining and the other enterprises in the handling of which we have been markedly successful.

Potash, Phosphate, and Arsenic Will Get Added Attention

Mineral Resources Division Plans Program—Core Drills Will Be Used for Potash Exploration

With the appropriations for the new fiscal year now available, the mineral resources division of the U. S. Geological Survey is planning to give particular attention to work on potash and phosphate. The discovery of potash in various oil wells in western Texas is regarded as ample justification for increased work on that mineral. The increased attention also is made possible by the fact that the Senate has passed the Shepherd bill, which authorizes an appropriation of $500,000, which will make it possible to prospect with core drills and to undertake a systematic and intensive effort to learn more concerning our potash resources.

The direction of the Division of Mineral Resources recently has been placed in the hands of F. J. Katz, who succeeds G. F. Loughlin as the chief of that division. Mr. Loughlin has been promoted to succeed Dr. F. L. Ransome as chief of the section of metalliferous deposits. Dr. Ransome has severed his connection with the Geological Survey so as to devote his full time to work on the faculty of the University of Arizona.

Mr. Katz also has in mind close attention to arsenic. Though the shortage of white arsenic seems to have been relieved to some extent, Mr. Katz points out that the demand is likely to reach much higher levels in view of the fact that only a small percentage of the cotton acreage is now being treated with calcium arsenate as an agent for controlling the boll weevil. The results which have followed its use, in the opinion of specialists at the Department of Agriculture, insure its ultimate adoption on the part of cotton growers generally.

This does not mean that there will be any reduction in the amount of investigation and work on the other more important minerals. Some curtailment, however, will be necessary on certain of the minerals of lesser importance, principally from the fact that the reclassification of salaries will absorb about 15 per cent more of the appropriation than was the case last year. There also will be a necessary reduction in the mineral resources field work. Some of the amount which will be absorbed by the increase in salaries will be offset by a slight reduction in the clerical force, by the elimination of certain canvasses and by the securing of additional assistance from the geological branch.

Abandonment of Gold Standard Far in Future

Talk of the possibility of the abandonment of the gold standard by other countries, leaving the United States holding the bag containing a large part of the world's gold, is not taken seriously by the country's leading economists. Great Britain, it is pointed out, is fully as much interested as are we in the maintenance of the gold standard, since that nation controls the larger part of the production of new gold. In addition, the British have much to gain by having the pound sterling continue as the basis for world trade.

Even were the other nations able to agree on the commodities which would make up the commodity standard, no such plan could be put into operation without the voluntary co-operation of the United States and Great Britain, it is pointed out. The countries which might give ear to the commodity standard are very heavily obligated to the two great financial nations. These obligations provide for settlement on a gold basis. Since Russia's sad experience with repudiation, no nation is considering that step. Internal debts may be wiped out by inflation, but there is no way whereby it may be applied to external obligations.

There will be no departure from the gold standard, it is predicted, until the United States and Great Britain are ready to acknowledge another basis of exchange.

Burma Has Another Big Lead-Silver Mine—Perhaps

Rich silver-lead ore has been discovered at Heho, near Kalaw, in the Southern Shan States, in Burma, and proprietary rights have been acquired by Messrs. Steel Brothers & Co., Ltd., of Rangoon, according to advices to the U. S. Department of Commerce. Heho is connected with Rangoon by rail, and, if the new find comes up to expectation, it will materially add to the commercial development not only of the Southern Shan States but of Burma as a whole.

A public announcement regarding the new find will be made soon, but at present engineers and geologists are engaged in examining the field and its possibilities, and much will depend on their final report. Burma has already one of the greatest silver and lead mines in the world, at Bawdwin, in the Northern Shan States. It is worked by the Burma Corporation, Ltd. The output of lead from this mine last year was 30,214 tons. The yield of silver totaled 4,205.584 oz.

Burma Corporation Mined 23,078 Tons of Ore in June

The Burma Corporation, Ltd., during the month of June mined 23,078 tons of ore at Bawdwin, Northern Shan States. Of this 22,160 tons was milled, producing 11,516 tons of lead concentrate, and 11,449 tons of lead-bearing material was smelted in the blast furnaces, producing 4,681 tons of hard lead for treatment in the refinery. Refinery products were 4,102 tons of lead and 432,675 oz. of silver. Of the silver production 6,000 oz. was recovered from the treatment of copper matte.

The experimental zinc plant produced 1,700 tons of zinc concentrate assaying 10.5 oz. of silver, 7.2 per cent lead, and 45.2 per cent zinc. In addition, 350 tons of copper matte was produced from the treatment of 1,702 tons of copper ore and accumulated smelter by-products. Mining operations are hindered as usual by the shortage of labor in the rainy season.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Tasmania Looks to Mining Industry for a Lift

But Mining Needs a Lift—Conference Discusses Questions of Sundry Government Helps

Melbourne, June 13, 1924—In the past, mining has come to the rescue of the country when trade has been bad. This was the case with the discovery of gold in Western Australia following the land boom days of the early 90's when the banks crashed. Tasmania, as a state, has probably benefited less from federation than any of the states, and appeals have been made to the Commonwealth Government to make a special case with Tasmania by giving it a financial grant. Mining has always been an important industry in the island state, but during recent years mining activities have waned considerably.

The Minister for Mines recently called a conference of mine managers and others interested to consider what could be done. Members of the Geological Survey Branch were also present. The minister said that the apex of taxation had been reached, and the government was looking to the mining industry to give the state a lift. A number of resolutions were passed by the conference, but whether anything practical will come of it remains to be seen. All sorts of questions were discussed, including the erection of state batteries, higher rewards for new discoveries, and greater security of tenure, but little or nothing was said about the real cause for the depression in mining namely, the high cost of labor and supplies.

The Amalgamated Zinc (De Bavay's), Ltd., having completed operations on the treatment of its dumps at Broken Hill, is looking for a new field of enterprise. The question of embarking on the development of the wood-pulp industry and the manufacture of paper is being investigated, and to this end D. Avery, a leading industrial chemist, who has been associated with the company in a consulting capacity, has been appointed to be a member of the board of directors.

The Electrolytic Zinc Co.'s new plant at Risdon, Tasmania, for the manufacture of fertilizers, is approaching completion, and the first cargo of 4,700 tons of rock phosphate from Nauru has been delivered.

Five Properties Being Developed in the Adair District

It is reported that the Montana-Idaho Copper Co. has cut a small vein of high-grade copper ore on one of its lower levels. On the adjoining property, controlled by a Spokane company, work is progressing on a 6-ft. vein that averages 6 per cent copper. This was only recently opened. Five different properties have been started within the last month near Adair, on the Montana-Idaho line.

London Letter

By W. A. Doman
Special Correspondent

What Ails West Springs? London Would Like to Know

Reaction Follows Climb in Shares—Official Denials of Adverse Rumors Not Forthcoming

London, July 8, 1924—There is some little disquietude in London in regard to West Springs (Far East Rand). For several weeks nothing too favorable could be said concerning the prospects, and there was of course no limit to the price the shares might reach. Now they are falling away, and the selling is said to emanate from Johannesburg. Previously when adverse rumors were in circulation official denials were made, and the market is now awaiting some further statement. No one seems to know why the shares should decline, as developments have been reported to be good, and the plant is said to be working satisfactorily.

Despite the fact that copper companies are not getting the price for the metal that they anticipated, the Union Minière du Haut Katanga continues to increase its output. Robert Williams has promised a yearly production of 100,000 tons at an early date. Last month the output reached the record figure of 7,259 tons, and as the January production was only 5,127 tons, it is clear that the 100,000 rate of production is being approached fairly rapidly.

Although little information is available, it seems that Henry Gardner & Co., Ltd, the well-known London metal merchants, have turned their business, or a part of it, into a private investment trust, under the name of the Stanstead Investment Trust, with a capital of £200,000 in £1 shares. No mention is made in the registration particulars of metals, the objects being to acquire certain investments and premises, and to acquire and hold shares, stocks, bonds, and other securities. The tendency seems to be to convert private firms of metal dealers into companies. The most active at the moment it the British Metals Corporation, with which Sir Cecil Budd is connected.

No decision has yet been reached for a joint working arrangement between the East Rand Proprietary Mines and the Cinderella Consolidated. That the directors of both companies would welcome an agreement seems to be clear from a statement by Sir George Albu that both had submitted terms to the Government Commission, on which, with the shareholders' approval, they could get to work. But there are debenture holders in each company, and apparently the sacrifice to be made by both share and debenture holders in the Cinderella company would be too great. There are substantial arrears of debenture interest in the latter, and as payments of principal have been delayed, and the prospects of the property have not altered, holders presumably think it better to wait until new capital can be raised. Neither plan has been published and there is much speculation as to terms.

Typical prospect in the Mount Isa district in Queensland

At the time when Sir George Albu acquired the old Transvaal Silver Mines and resumed operations, there seemed a probability of a fairly large body of silver-lead ore being opened up. Results were so encouraging that a proposal was made to list the shares on the London Stock Exclange. Before making an active market, however, it was decided to sink further. The result has not been satisfactory, and development work at the mines has now almost ceased.

Rush to Cadillac Township, Quebec, Follows Gold Discovery

The M. J. O'Brien interests of Cobalt, Ont., have sent a force of twelve men to trench the surface on the claims recently acquired in Cadillac Township, Que., by A. Dumond, prospecting for the O'Brien. The discovery, with spectacular showings of gold, resulted in a rush of prospectors from northern Ontario, and much of the surrounding territory is staked out; but the heavy overburden makes prospecting slow. J. G. Dickenson, manager of the O'Brien, will visit the district about the middle of August, when sufficient of the surface will have been exposed to enable him to estimate the importance of the discovery.

Melbourne Letter

By Our Special Correspondent
Queensland, Australia

Government Geologist Reports on Mount Isa Silver-Lead Field

Noncommital on Continuation of Ore Deposits—Developed for Three Miles on Surface

Brisbane, June 17, 1924—A report by B. Dunston, chief government geologist for Queensland, on the silver-lead deposits found at Mount Isa, fifteen months ago, has just been published. Mr. Dunstan gives a preliminary description of the geology of the field, which he says contains numerous and complex geological problems that must be investigated sooner or later with a view to affording information bearing on the behavior and continuation of the ore deposits. The country is described as being made up of long lines of hills and ranges, alternating with plains and gently undulating hills, extending for hundreds of miles. The ridges are sometimes precipitous and rugged, and in some places inaccessible.

Though the length of the lines of lode cannot yet be determined, as every week new developments are taking place, the most productive area is about three miles long; but beyond this limit the outcrops of the lodes in places are quite marked and may develop into rich deposits. To the north the outcrops are very encouraging, and to the south one of the leases (the Silverlena) contains an important development, with lodes evidently continuing further south, although the extensions, both north and south, are much more narrow than the middle part.

Mr. Dunstan says the individual thickness of the ore bands and lodes varies from a mere fraction of an inch to several feet; and, while in some outcrops quite a number of fine regular bands of ore are to be observed separated by bands of ironstone, clay, or ribbonstone, in the width of a foot, other occurrences show bands of ore a foot or more in sections and massed together to make up a formation perhaps 12 or 15 ft. thick. Again, very

Mount Isa silver-lead district
This view shows the rolling hills of Australia's newest mining region. Outcrops have been traced for three miles

thick beds, about a foot in width, are separated from one another by several feet of barren country; then again numberless small bands of ore are spread over an area of perhaps 50 ft.

The abundance of the ore bands and lodes, the geologist adds, is a marvelous feature of the Mount Isa field; and, although their outcrops along the surface have not yet been proved to be continuous in the regularly bedded rocks, it seems almost impossible that they do not continue both along the surface and to a considerable depth below.

Probably in every pit, trench or pot hole sunk along the line of outcrops within the three-mile limit some ore has been found within a foot or two of the surface. Moreover, as there are scores of places—perhaps hundreds—where trenching will have to be undertaken, more lodes will be discovered later, below the superficial coverings or below the gossan outcrops, than are now exposed on the surface.

Impossible to Predict Continuation of Ore in Depth

In the case of a disturbed area in the center of the field, the irregularity in the stratification makes impossible any conclusion regarding the continuation of individual orebodies in depth, even though they may be large and very rich on the surface. Nevertheless, though such deposits may pinch out or become larger, below the surface, the whole character of the area, in Mr. Dunstan's opinion, points to other separate deposits existing below, equal in every respect to what is exposed—a feature which probably extends to all depths where disturbances of the strata in the principal central zone have taken place.

Indeed, in places where no mineral is to be seen, there must, in the view of the geologist, have been excessive leachings in the iron-manganese outcrops, and deep prospecting may reveal rich secondary deposits having no surface indications at all. In support of this view, it is mentioned that where a band of carbonate ore occurs between outcrops of ribbonstones, the ore exposed right on the surface, and in a horizontal continuation of the same strata and the same ore channels to places where there has been no silification to ribbonstone, and where the beds are ferruginous and porous, there is no appearance of mineral, yet prospecting has in all such cases revealed its presence below.

New Type of Tin Dredge in Malay States

A number of tin-dredging companies in the Federated Malay States and also in Australia are adopting the Thompson Revolving Suction Cutter Dredge in place of the ordinary form of bucket dredge. The plant is mounted on a barge and provides a complete mineral saving equipment. The manufacturers claim that the initial cost is about half that of a bucket dredge of equal capacity and that the operating costs are also less. The freedom from obstruction on the barge makes more space available for the installation of the sluice boxes.

Mexico City Letter

By W. L. Vail

Special Correspondent

Mexican Treasury Suspends Decree Involving Reimportation of Gold

Purpose Was to Stop Decline of Silver Peso—T. Skewes Saunders Discusses Question

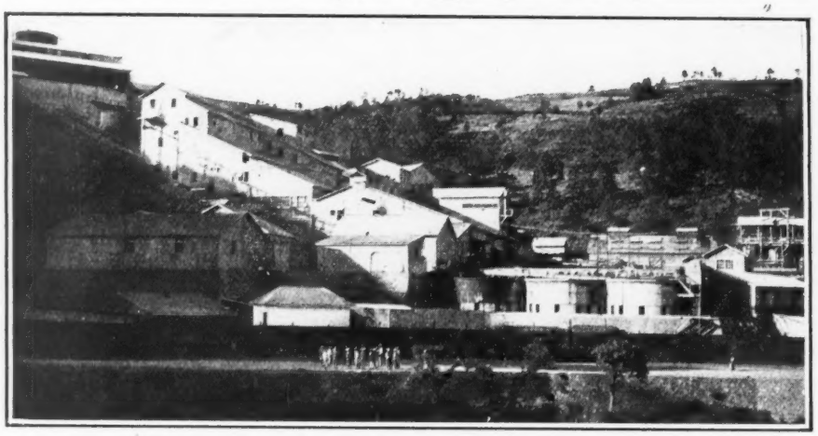
Mexico City, July 12, 1924—Mining companies operating in Mexico have apparently convinced the Mexican Secretary of the Treasury that the recent decree requiring reimportation of gold to cover mineral exports having gold content was a mistake, and the decree has been suspended.

According to the decree, every one thousand pesos of gold, in any form whatever, exported, must be replaced by a reimport, either in gold coins or pure gold, of an equal value. The miners claimed that this was equivalent to an increased taxation of nearly 5 per cent, on top of an already heavy burden.

The object of the decree was not in reality to secure more revenue, but was an attempt to stop the rapidly declining price of the silver peso. Similar decrees were issued under the Carranza regime, and withdrawn when the crisis was passed. T. Skewes Saunders, mining engineer, sets forth, in this connection, some illuminating ideas. "The new and more onerous feature," according to Mr. Saunders, "is that the exporter of silver ore is affected in that he must reimport in gold currency, or pure gold, a value equivalent to 25 per cent of the intrinsic value of his silver exportations. In other words, if a silver miner exports silver values in any form whatsoever, whether as concentrates, raw ore, or mixed bars to the value, say, of $1,000, he will have to reimport gold or gold coins to the value of $250. For further illustration I may take the case of either concentrates, raw ore, or mixed bullion to the value, say, of $1,000 in which the gold would amount to $500 and the silver to $400. The exporter would then have to reimport gold to the full value of that being exported, or $500, whereas of the silver values he would have to reimport 25 per cent, or $100, also in pure gold."

The object of this decree is, of course, to stabilize the relative value of gold and silver coinage. At present, gold is at a premium of about 4 per cent. This condition is brought about, according to Mr. Saunders, by the fact of there being an abundance of silver for coinage purposes and a marked scarcity of gold. The Mexican Government believes that by taking a stand, there will in a relatively short period be such an amount of gold available for coinage purposes that gold coins of all denominations will be just as common as silver pesos and that consequently the relative scarcity of gold and its corresponding premium will speedily disappear.

Other opinions are that no matter how much gold is reimported, or imported, it will either be absorbed by the banks or by the government and that in view of the fact that practically everybody has adopted the habit of changing gold currency into silver pesos, there may be some reason for supposing that this practise will continue and that the aim of the government to neutralize the disparity between the two metals will be ineffective.



Guerrero mill of the Cia. de Real del Monte at Pachuca, Mexico

In this connection it is interesting to note that the coinage of silver money keeps apace, rather than diminishes as shown by the following statistics: In January the silver coinage, pesos and half pesos, amounted to 2,040,000; February, 3,240,000; March, 5,100,000; April, 4,600,000; May, 5,040,000 and the estimate for June is nearly 6,000,000. Something over 100,000,000 silver pesos of a somewhat depreciated value over the old peso are now in circulation.

While the increased tax, as proposed, made an addition of something like 5 per cent, according to calculations of the miners, it is claimed that the government would receive little or no benefit, as most of this amount would go into transportation, insurance, and similar charges.

The application of the new income tax to mines is so vague and full of contradictions that a commission consisting of two experts from the Finance Department, two from the Department of Commerce and Industry, and a technical official from the Petroleum Section has been appointed to make the provisions of the regulations clear, if possible.

Men You Should Know About

G. W. Wallace is in Chicago.

Morton Webber is in Switzerland.

E. H. Rose, of Nacozari, Sonora, Mexico, is in Los Angeles.

C. B. Kingston will visit Canada on his return to Rhodesia via the Pacific.

E. L. Oliver is on vacation at Lake Tahoe, Calif., after a minor operation.

Dr. A. A. Pegan is acting professor of geolory at the University of Virginia.

H. N. Spicer is in England. He expects to remain in Europe until late in the year.

E. David Pope is in charge of the smelter of the Cia. Minera del Pacifico at Coquimbo, Chile.

H. W. Edmondson is back at the Rio Plata Mine, Guazapares, Chih., Mexico, after a short visit to New York.

F. W. Bradley is expected back in San Francisco from Placer County, Calif., toward the end of the month.

T. K. Scott, who has been chief engineer for the Miami Copper Co. for several years, has resigned his position.

Fred Searls, Jr., of San Francisco, geologist and mining engineer, was in Wallace, Idaho, on July 11 on professional business.

F. W. Collins, formerly of the Cerro de Pasco Copper Corporation, Peru, is now with the Joshua Hendy Iron Works Co., San Francisco.

A. B. Parsons, assistant editor, *Mining Journal-Press,* has returned to New York from his recent trip through several Western mining districts.

Max Hayden Barber, district superintendent on the Mesabi iron range for the Cleveland Cliffs Iron Co., is attending the annual meeting of the company in Cleveland.

C. H. Abeling, metallurgist, has completed seven months' work for the General Engineering Co. at Iron Mountain, Mo., and has returned to his home in Salt Lake City, Utah.

Frederick Burbidge, of Wallace, Idaho, general manager of the Federal Mining & Smelting Co., is in Oklahoma, where the company is extensively engaged in zinc mining.

Clyde A. Heller, president, and **L. R. Robins,** superintendent, of the Tonopah Belmont Development Co., left Tonopah on July 12 en route to the company's property at Surf Inlet, British Columbia.

L. O. Howard, dean of the School of Mines and Geology, State College of Washington, at Pullman, Wash., is making an extended trip through the mining districts of northeastern Washington.

Gerald G. Dobbs, general superintendent of ore mines and quarries of the Tata Iron & Steel Co., Ltd., India, is on leave visiting friends and relatives in the United States. Mr. Dobbs will return to India in August, sailing from Quebec on the "Empress of Scotland" on Aug. 27.

D. G. Kerr, vice-president, and **W. G. Shiras,** ore agent of the United States Steel Corporation, were recent visitors to the properties of their company on the Mesabi iron range. They were accompanied by **W. J. Olcott,** president, and a group of the officials of the Oliver Iron Mining Co., of Duluth.

H. M. Hanna, president of the M. A. Hanna company, accompanied by **George H. Humphrey,** vice-president, **R. S. Walker,** consulting engineer, and **C. N. Heckok,** manager of ore sales, made a trip of inspection to the properties of their company in the Lake Superior iron ore district last week.

George J. Young
Associate Editor, "Mining Journal-Press"

George J. Young, associate editor of *Mining Journal-Press,* has just returned to his San Francisco headheadquarters after a field trip, during which he visited mining districts in Utah, Idaho, Oregon, Washington and California. Mr. Young reviews the trend of the mining industries on the Pacific Coast on pages 135 and 136 of this issue.

Fred A. Starkey, of Nelson, B. C., commissioner for the Associated Boards of Trade of Eastern British Columbia, has been appointed by the British Columbia Chamber of Mines to represent the mining industry of British Columbia at the British Empire Exposition. Mr. Starkey left for Wembley on July 6.

Fred Carroll, of Ouray, Colo., general manager of the Atlas Mining Co. and Colorado member of the Silver Export Association, with **Jesse F. McDonald,** of Leadville, manager of the Down Town Mines Co. and Colorado member of the Silver Producers' Association, have been selected to represent Colorado at the silver producers' meeting which has been called to convene in Salt Lake City, Utah, on Aug. 6.

Dr. H. E. T. Haultain, professor of mining engineering at the University of Toronto, spoke before the Columbia section of the American Institute of Mining and Metallurgical Engineers, at Spokane, Wash., on July 10. The meeting was attended by Frank M. Smith, who presided; L. O. Howard, dean of the school of mines at Washington State College; G. W. Evans, of Seattle; Frederick Keffer, E. G. Taber, and Howard Melvin, engineers of Spokane.

Robert J. Grant, director of the U. S. Mint, arrived in Denver on July 17, on a tour of inspection of several Western states. "The rapid rise of silver places it at 68c. an ounce," Mr. Grant said, "with indications pointing toward a continued high price. One of the most important causes for the present price is the favorable attitude of European nations toward the Dawes plan. Another cause for the favorable market is the fact that a large amount of silver is being shipped to Oriental countries. Orders for the metal from the Eastern countries, however, come in spells, and it is probable that the present demand from this source is only temporary."

Arthur Moore, engineer and boring expert, is acting as working superintendent of the Queensland Petroleum, Ltd., the latest company, having a capital of £100,000, formed to prospect for oil in the most northern state of the Australian Commonwealth. Mr. Moore, except in 1916 and the two following years, has been continuously engaged in drilling and the supervision of wells since 1895. In the three wartime years mentioned he was in the service, as an expert, of the petroleum-development department of the British Ministry of Munitions. His last position in Queensland was that of engineer and driller in charge of the Roma state oil bore. When that venture, as a result of difficulties that had been encountered before he had control, was, on his recommendation, closed down in 1922, Mr. Moore went to America for the purpose of bringing his oil-drilling knowledge up to date, and was there engaged in oil-well sinking, a part of his experience being obtained in the service of the Chanslor-Canfield Midway Oil Co., of British Columbia, Canada. After returning to Queensland, Mr. Moore, with a partner, obtained government permits to prospect for oil on promising country about 60 miles west of Roma, and it is to work this area that the company of which he is now manager has been promoted.

Obituary

A. B. W. Vandermark was murdered recently at Twin Falls, Idaho. He had practised as a mining and oil engineer in the United States, Mexico and South America. E. V. Larson, of Twin Falls, is anxious to get in touch with relatives of the deceased, some of whom are supposed to be living in New York City or New York State.

William A. Gallagher, tunnel foreman for the Southern California Edison Co., died on July 10 as a result of an accident caused by a fall of rock in one of the tunnels of the Big Creek project on the previous day. He was well known in Nevada, having been connected with the Seven Troughs property, near Lovelock, and the Packard mines, near Rochester. He was a native of Colorado and was thirty-one years old.

Societies, Addresses, and Reports

World Power Conference Held at London

More Than 400 Delegates From Thirty-eight Countries Convene —Several Hundred Papers Presented—Steps Taken to Effect Permanent Organization

REPRESENTATIVES of thirty-eight countries gathered in London during the first week of the World Power Conference to discuss the technical, economic, and financial problems of power development and its utilization. About 125 American delegates were in attendance, about 150 from Great Britain and 160 from other countries. A large number of papers was presented—several hundred in fact, said to average about 8,000 words apiece, and in which there was much duplication of experience from the many countries represented.

The keynote address—a constructive speech—was delivered at the opening session by the Prince of Wales, honorary president of the conference. The Earl of Derby presided. In reply to the Prince, Sir Joseph Cook spoke for the British Dominions and said that while today the world needs a balance of accounts rather than a balance of power, this could be attained only by developing power to the fullest extent and by seeking new sources of power. M. Guillaume replied for France, Guido Semenza for Italy and the rest of Continental Europe. Dr. Kamo spoke for Japan and other Asiatic countries.

Spokesman for the United States and South American countries was O. C. Merrill, Secretary of the U. S. Federal Power Commission.

The opening ceremonies included a formal banquet with almost 800 guests, at which the Earl of Derby again presided. He said that most post-war conferences had been unproductive, but that since this one dealt in realities it ought to have definite and concrete results. Among the speakers was Samuel Insull, of Chicago, and Dr. S. Z. de Ferranti. Mr. Hodges, Civil Lord of the Admiralty, represented the government at the banquet. The American Committee also gave a dinner to the other delegations during the week.

Power Resources Surveyed

The business sessions were devoted to the survey of power resources of the world; economic-financial, legal and government policy, aspect of power development; water-power development; steam power plants and equipment; and the preparation of fuels. Discussion of the power resources served to develop the proposition that there is needed—and the conference may formulate some suggestion—some definite, uniform or standard method of stating the water-power capacity of a stream so that adequate comparisons may be made. Little discussion was possible, as the program included fifty-five papers on power resources alone, to be presented at two sessions.

More time was available in the sessions on the economic and financial aspects of power development. The inability of the European countries to finance adequately until there is a more stabilized currency in those countries was made most evident at these sessions. The papers presented by some of the bankers brought this fact out most forcibly.

In discussing the social phases of power development, J. P. Noonan, of the United States, president of the organized electrical workers and representing the American Federation of Labor, stated unequivocally that labor stands ready to co-operate to the fullest extent in the development of power. The present labor movement realizes, said Mr. Noonan, that labor-saving machinery is really in labor's benefit. He urged a closer contact and understanding of labor and employer. Labor should learn from the leaders of the power industry, "who are of higher caliber, as proved by the positions you have attained," what to do to remove any shackles which may hamper the power industry from its proper and early complete development.

Government's Place in Power Development

As to government policies in power development, the large majority of views held to the principle that government should do all it can, within the confines of true government, to make power development possible, but that government itself, nor its creatures, should not enter into the ownership and operation of power plants and systems. There were some divergent views.

Other sessions of the week were principally technical in nature and in many ways resembled meetings of technical societies in the United States, except that experiences brought about by widely different conditions have been brought together. Water-power production and its civil and mechanical engineering features occupied one group. There were two very interesting sessions on steam power plants. The discussion here was directly largely toward pulverized fuel and boiler construction. In the matter of the former, the principal questions were as to the American experiences.

Interest in Powdered Fuel Displayed

There were also three sessions, in which there was a great deal of interest, on the problems connected with the preparation of fuels. Here, also, the principal interest seemed to center in powdered fuel, and American experience was called upon to answer most of the questions. There was also a great deal of interest in coal distillation processes, extraction processes, and similar matters, but none was offered as having proved economically satisfactory. Some of the most ardent advocates of distillation or low-temperature carbonization urged that, since it was a desirable move to make, it should be done by government subsidy if not otherwise, but that seemed to many to be going too far and not to be an engineering suggestion.

Steps to continue the work of the Power Conference were taken, and the advisability of forming a permanent institution later was considered. Organization and/or maintenance of a permanent National Committee was suggested to each country, each of these committees to appoint one delegate to represent it on the International Committee. A date will be set for a future meeting of this International Committee.

The present organizing director, D. N. Dunlop, and his staff will continue temporarily as the medium of communication between the countries represented.

Time and place for the next meeting of the World Power Conference will be determined by the International Committee subject to the approval of the respective national committees. Future conferences will be held in different countries so far as practicable.

Safety Engineers Will Meet at Ironwood Aug. 12

The fifth annual conference of the Lake Superior Mining Section of the National Safety Council will be held Aug. 12 and 13 at Ironwood, Mich. A large attendance of mine superintendents, captains, engineers, foremen, and county mine inspectors is expected. William Conibear, of Ishpeming, Mich., is chairman of the conference. Addresses will be given by Alex D. Chisholm, district manager, Pickands, Mather & Co., Ironwood; W. F. Pellanz, Jr., assistant general superintendent, Oliver Iron Mining Co., Eveleth, Minn.; R. G. Knutson, commissioner, Industrial Commission of Wisconsin; C. W. Nicholson, mining engineer, Cleveland-Cliffs Iron Co., Ishpeming; A. A. Krogdahl, safety engineer, Oliver Iron Mining Co., Virginia, Minn.; C. E. Lawrence, general superintendent, Pickands, Mather & Co., Iron River, Mich.; W. R. Rasmussen, field secretary, National Safety Council, Chicago; and the Rev. Axel Pearson, Ironwood. Discussion will follow presentation of papers. The conference will conclude with an inspection of Gogebic range mines.

May Postpone Meeting of Lake Superior Institute

The 1924 session of the Lake Superior Mining Institute, scheduled to be held in August on the Marquette iron range, probably will be postponed until next year on account of depression in the iron business. A trip to the Ontario mining districts has been planned in lieu of the Michigan meeting, but as less than half of the number required for a special train have signified their intention of making such an excursion it is unlikely it will be made.

Recent Technical Publications

Reviews, Abstracts, and References

Liquid Oxygen Explosives

Das Sprengluftverfahren (Liquid Oxygen Explosives Practice). By Bergassessor Leopold Lisse. Julius Springer, Linkstr. 23-24, Berlin, W. 9, Germany. Price $1.20.

This monograph of 109 pages and 108 figures, written by the director of the Oxyliquit-Sprengluft Co., gives an interesting exposition of the methods of manufacture of liquid oxygen by the three German liquefying machines, the Lindé, Haylandt, and Messer, and also by the French type, the Claude; construction of metal carrying and dipping containers; properties of the patented Sprengluft cartridges; and blasting practice for L.O.X., and presents accident statistics and cost figures. The value of the monograph from a technical viewpoint is impaired by the necessity for vague treatment of certain points—for example, composition of the different types of L.O.X. cartridges, due to the writer's connection with a commercial organization engaged in developing L.O.X. Much of the material has appeared in previous papers by the same author and other authors, but a number of interesting developments are described for the benefit of those able to read German.

Rectangular dipping containers, in which the cartridges may be placed lengthwise, are said to result in considerable saving over the cylindrical type, because of the fact that the cylindrical container, in which the cartridges are upright, must be kept full of liquid whatever the number of cartridges being dipped.

The so-called K cartridge, which is claimed to be safe for use in gaseous and dusty coal mines, is a recent development. It has a theoretical explosion temperature of around 1,900 deg. C., and a rate of detonation of 2,700 meters per second. No noxious gases are given off by the explosion of this type of cartridge. Other cartridges similar in effect to ammonia, nitroglycerin, and gelatin dynamites are described, which have rates of detonation varying from 3,200 to 5,000 meters per second.

A new type of delay-action electric detonation is described, which does not make use of the usual fuse, and is especially desirable for use with L.O.X. because of its small length. The total length of this type of detonator, for a delay of nine seconds, is three inches, against nine inches for the German delay-action detonator using fuse. Detonators of this length may be placed in the boreholes in a small wooden block and connected ready for firing before the loading of cartridges is begun. This procedure decreases the loading time considerably, and avoids the danger of premature ignition which may take place with the long delays, these usually being placed inside the cartridge to avoid dead space at the bottom of the borehole.

Accidents per million tons of ore during the years 1919-1921 are said to have been 6.4 times as numerous with ordinary explosives as they have when using L.O.X.

The cost of a plant with a capacity of 30 kg. of liquid oxygen per hour is given as 36,000 gold marks. A 15-liter carrying container costs 120 gold marks; 1½ kg. of oxygen at the plant are equivalent to 1 kg. of dynamite, and 3 kw.-hr. is required to produce 1 kg. of oxygen. About 50 per cent of the oxygen produced at the plant is contained in the saturated cartridges, the remainder being lost by evaporation in transport and dipping containers, and in residue left in dipping containers. In a blasting operation using 120,000 lb. of ammonia dynamite annually, the author estimates a saving of 70 per cent by the use of L.O.X.

Mr. Lisse has assembled under one cover a considerable amount of data, and the monograph will repay reading by anyone interested in liquid-oxygen explosives. G. St. J. Perrott.

The West Springs All-sliming Cyanide Plant

The latest all-sliming reduction plant on the Rand is that of West Springs, Ltd., on the Far East Rand, which has gone into operation in the last two or three months. A brief description appeared in the *South African Mining and Engineering Journal* of June 7. (Johannesburg; price 6d.)

A novel feature of the West Springs plant is the ore stockpile, a conical dump of a capacity of 7,500 tons. Ore is drawn from the stockpile by means of a 36-in. conveyor belt fed by a Robins' shaking feeder, the belt being installed in a concrete tunnel under the dump, the level of the tunnel being partly above and partly below the ground. Twin tunnels have been provided, but at present only one is equipped with a belt. The arrangement permits of approximately 2,200 tons being drawn from the stockpile by means of one belt, without shoveling. The equivalent capacity with two belts is approximately 2,800 tons.

The 36-in. conveyor from the stockpile delivers the ore to the washing plant. Here the ore passes over a grizzly with ½-in. spacing, and is subjected to a considerable stream of water, passing thence to a 60-in. draining belt. The wet undersize of the grizzly and the drainage from the belt passes over perforated dewatering plates, the oversize of which is conveyed by belt to the main belt feeding the tube-mill bins. The underflow from the perforated plates is laundered to one of two alternate leaching tanks; the slime overflow from the tank in operation is pumped to a 10x8-ft. classifying cone, the overflow of which passes to one of two 50-ft. diameter by 12-ft. by 15-ft. deep slime collecting tanks, and the underflow is returned to the leaching tank.

The principal object of the washing plant, apart from the necessary washing of coarse ore prior to sorting, is to secure a cleaner product on the conveyor belts, with consequently lessened cost of maintenance. Ore is delivered from the 60-ft. draining belt over a grizzly set with 1¼-in. spacing, the undersize of which is transferred by conveyor belt to the main conveyor belt feeding the tube-mill bins, and the oversize is divided on to two sorting belts.

Sorting is done on two 36-in. conveyor belts. The waste bin has a capacity of 825 tons. The tube-mill pebbles are picked near the head of the belt and deposited in the 180-ton pebble bin. The balance of the ore on the belt is delivered into a steady-head bin feeding two No. 6-N type Gates gyratory crushers.

The whole of the plant is housed in one building approximately 165 ft. by 155 ft. The main storage bin contains 2,000 tons. The bottom of the bin is of the saw-tooth type. Thus the bottom of the bin delivers alternately to four tube mills on each side staggered in relation to each other. This allows the tubes to be set at 30-ft. centers and still secures a self-emptying bin. It is thought that this arrangement lends itself to compactness and ease of supervision, and at the same time provides adequate lighting for the feed ends of the tube mills.

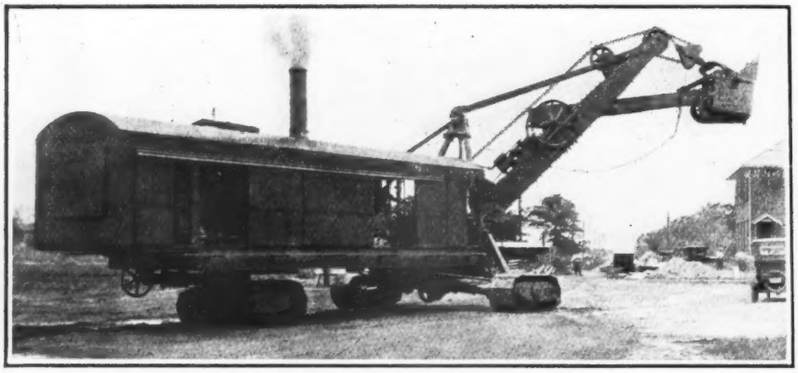
Ore is distributed in the main bins by means of a tripper. The eight tube mills are each driven by a 250-hp., 500-r.p.m. motor direct-coupled to a totally inclosed single-reduction gear driving the tube-mill countershaft. Each tube mill has its own pebble bin of twelve tons' capacity. The feed to the tube mills is regulated by short belt feeders having three speeds, actuated by ratchet and pawl. The tube-mill effluent is divided by ½-in. mesh trommel into reject pebbles, which are transferred by belt conveyor to the reject pebble plant, and pulp, which is elevated by means of cyanide solution supplied under pressure to an 18 ft. 4 in. by 8 ft. D-type Dorr classifier. The oversize of the Dorr classifier is returned by gravity to the tube-mill feed hopper, and the overflow, which is the finished product, passed to the main slime launder leading to the main pulp elevating pump, which delivers direct to the slime collecting tanks. The tube mills are 6 ft. 6 in. diameter by 20 ft. long.

Agitation is carried out by means of seven 45 ft. by 15 ft. agitating tanks, whence it is pumped to the Butters' filter plant. The latter is of the all-gravity type, and there are sixteen hoppers, containing 480 leaves.

Milling is done in cyanide solution of an approximate strength of 0.01 per cent KCN and 0.02 per cent CaO. Make-up cyanide is added at the return solution tanks.

Some of the tube mills are being equipped with a new type of liner, and judging by information obtained from other users, this liner will increase the monthly tonnage by approximately 25 per cent.

The Crowe-Merrill precipitation plant, together with the acid gold slime-treatment plant, clean-up plant and furnaces, are all housed in one building, to secure ease of supervision.



Three and one-half cubic yard shovel equipped with continuous-tread mountings

New Machinery and Inventions

New Mounting for Shovels Introduced

Continuous-tread equipment has recently been added by the Osgood Company, of Marion, Ohio, to its line of mountings for standard shovels, supplementing the railroad truck and traction mountings. The tread mountings are made for shovels of dipper capacities ranging from 1½ to 6 cu.yd. They can be put on in the field to replace other mountings and, it is said, can be easily removed when it is necessary to move the shovel by rail. The advantages claimed are, briefly, that track and accessories are eliminated; the pit crew is dispensed with or greatly reduced; the shovel can be kept in the most effective digging position, can back away from blasting, and can travel and work in water; and that the time required for changing locations is greatly reduced. The continuous-tread mounting enables the shovel to travel and work on comparatively broken and faulted and moderately soft surfaces.

The mounting consists of two continuous-tread belt units carried on side brackets, replacing the jack arms at the forward end of the machine, and a narrow, double belt truck occupying the same position as the rear railroad truck. The side brackets are rigidly attached and braced. The mounting is illustrated in the accompanying cut.

Grease Cup Improved

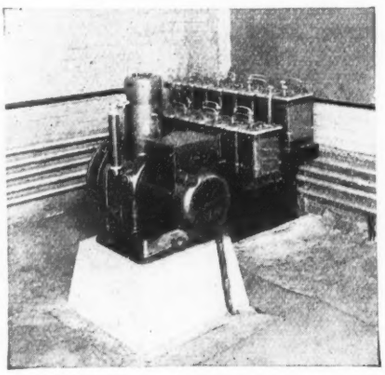
Recognizing that while a grease cup is a small matter in a plant it can nevertheless be a nuisance and a cause of expense far out of proportion to its cost, the Link-Belt Co., of Indianapolis, has developed a new top for the company's regular compression grease cup. This top is hexagonal in shape, which is intended to provide not only a good grip for the hand but one for a wrench. Cold, stiff grease makes a compression cup very hard to turn, and a pipe wrench is not always accessible.

The cup is also provided with a raised slot so that it can be turned with a screwdriver when it is so located that it is inconvenient for the hand or wrench. It is made of malleable iron, and said to be absolutely grease-tight

Small Power and Light Plant Developed

It will interest those who, because of their location, are obliged to generate their own electrical energy, to know that the Westinghouse company has recently put upon the market a new, efficient, light and power generating plant, known as Type E-30, equipped with a 3,000 watt-hour battery, thereby insuring an even supply of electricity.

The plant has a capacity of 750 watts at 32 volts, and operates on kerosene or gasoline. Natural gas may also be used as a fuel by the attachment of a special device. The electric generator is bolted to the internal-combustion engine, thereby making a compact and complete unit. The single-cylinder, four-cycle engine has a rating of 1½ hp. The bore of the cylinder is 2½ in., and the stroke is 4 in. The engine is lubricated by the splash feed system, which gives excellent results. From the 2-gal. fuel tank built into the base of the plant, fuel is drawn up by suction to the simple Venturi mixing valve. The two-pole generator is of



Small light and power generating plant with storage battery

the sleeve type, and is shunt wound, with series field for starting. This unit conforms to the specifications of the National Board of Fire Underwriters.

Simplicity of design, ruggedness of construction and safety are claimed for the apparatus. Anyone, it is said, is capable of running it.

Smokeless Stoker for Small Units

A new stoker has recently been placed on the market by the Stoker Sales Co., 650 Old Colony Building, Chicago. It is designed to introduce coal (screenings or any coal below the grade of No. 2) into a boiler, burn it smokelessly, then care for the ash element by discharging it into a receiving hopper. The stoker is a self-contained unit, and, it is claimed, is adaptable to all heating and steam-making boilers without expensive alteration.

Forming the base of the coal hopper there is a reciprocating plate carried on roller bearings which has a travel up to 5 in.—the length of travel determining the amount of the coal fed. The grates are terraced or stepped and are arranged in series, the first set of grate bars resting upon and sliding over the second step of the grate. The first and third grates have a forward-and-backward sliding motion (their action being simultaneous), and the second and fourth grates are stationary. By this motion the grate bars literally slide out from under the coal, the bed of coal being disturbed only by its fall over the ends of the grate bars. Because of this action, even coal with coking properties can be burnt with an efficiency equal to that obtained from non-coking coals.

At the rear of the stoker is a plate or table directly under the ash opening. This supports the body of the ash as it falls from the fourth grate. Having a reciprocating action, it also provides a slow but definite travel of the ash toward the front, but at all times filling the throat or ash opening so as to seal it against an inrush of cold air. In this way practically 100 per cent of the ash heat is retained and complete combustion is made possible.

Either natural or forced draft can be employed, and the stoker is operated by a ¼ hp. motor or hydraulic drive of equivalent power. There are only three moving parts in the entire mechanism, so that the amount of power required for operation is small. The stoker is intended for units ranging from 250 hp. downward.

Trade Catalogs

Superheaters—"Origin, Development, Results of Elesco" is the subject of a booklet which is published by the Superheater Co., of New York and Chicago, manufacturers of Elesco superheaters. It gives in brief form the history of company and the growth of its operations up to the present as a manufacturer of superheaters for every type of steam boiler in locomotive, marine, and stationary services. The development of the use of high-degree superheated steam is traced from the earliest experiments of the late Dr. Wilhelm Schmidt, of Cassel, Germany, to the present tendencies in steam generation in this country.

Drafting Room—A catalog of drafting room furniture has been received from the C. F. Pease Co., 871 N. Franklin St., Chicago, Ill. This is catalog F 24, illustrated, 40 pages. A copy will be sent on request to the company.

The Market Report

Daily Prices of Metals

July	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
17	12.125@12.25	45.375	45.875	7.00	6.70	5.85@5.90
18	12.125@12.25	45.875	46.375	7.00	6.75	5.85@5.875
19	12.25	46.75	47.25	7.00	6.775	5.875
21	12.40	47.50	48.00	7.00	6 80	5.85@5.90
22	12.55	48.00	48.50	7.05	6 85	5.90@5.95
23	12.65	47.50	48.00	7.25	6.90@7.00	6.00@6.05
Av.	12.371	46.833	47.333	7.05	6.804	5.906

*These prices correspond to the following quotations for copper delivered: July 17th and 18th, 12.375@12.50c.; 19th, 12.50c.; 21st, 12.65c.; 22d, 12.80c.; 23d, 12.90c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
17	60 5/8	61 5/8	64 3/4	229 1/2	230 3/4	32 7/8	30 1/2	31 7/8	31 3/4
18	61 1/8	62	65	231 5/8	233	32 13/16	30 5/8	31 15/16	31 11/16
21	62 1/4	63 1/4	66 1/4	241 1/2	242	32 1/2	30 3/4	32 1/8	32
22	62 3/8	63 3/8	66 1/2	245 1/2	245 1/2	32 7/8	31 1/4	32 1/4	32 1/8
23	62 1/2	63 1/2	66 1/2	242	242 1/4	33 1/8	31 5/8	32 5/8	32 3/8

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver		Gold London	July	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
17	4.36 7/8	67 1/8	34 9/16	94s 4d	21	4.38 1/2	67 1/4	34 3/8	94s 2d
18	4.36 1/2	67	34 7/16	94s 6d	22	4.40	67 3/8	34 5/16	93s 11d
19	4.38	67	34 5/16	.....	23	4.40	67 1/2	34 5/16	93s 9d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Copper, Lead, and Zinc Advance in Active Market

New York, July 23, 1924—The metal markets have been exceedingly active in the last three days, and prices generally have advanced. There is no scarcity of supplies, so that consumers need not fear any panic, but sellers are certainly not forcing any metal on the market nor actively competing for business. Fundamentally there is no marked change in the situation. The improved condition of the market has no doubt been caused principally by recent advances in the stock market, which is discounting a considerable improvement in general business conditions in the fall. Stock-market followers have been giving particular attention to the copper stocks, and this has increased the optimism of sellers.

Progress towards acceptance of the Dawes report has also had a sentimental effect, though we believe that the importance of a settlement of this matter so far as metal buying goes has been overemphasized. Continental Europe has been an excellent consumer of American copper, lead, and to a less extent, zinc, for some time, and no sudden gush of orders should be expected when the Dawes agreement is signed. Germany has ample credits for buying copper already and the principal way that a reparations settlement will help metal buying will be through a stimulation of general business conditions through lower interest charges.

The domestic metal market has been technically ready for an advance for some time, as buying has been only from hand to mouth as necessity compelled. Now that prices are tending upward, buyers are naturally asking for somewhat more than their immediate needs, which, of course, only adds fuel to the flames. The indications are that the present strength is not a temporary flare-up, as it seems to be based on improved business prospects throughout the world.

Copper Close to 13c. Today

A buying move was in evidence as early as Saturday, and in the last three days a large volume of business has been done. It is significant that few large orders have been placed, most of the business being for lots of from 100 to 500 tons. On Thursday and Friday, copper sold freely in the East at 12⅞c., delivered, for early shipment, though 12½c. was done for September-October, and for delivery west of the Alleghanies. On Saturday 12½c. was the ruling price for Valley points for July-August-September, followed by an advance to 12⅝c. on Monday, and 12¾c. on Tuesday. Today, most of the copper that has been sold has brought 12⅞c. delivered, but the demand seems more than sufficient to take care of the offerings at that level. For distant points and for deliveries running into December, as high as 13¼c. has been paid, but producers are not in general disposed to sell beyond September, or October at the latest.

The foreign demand has been continuously good throughout the world and the advance in London on Monday had a great deal to do with the improvement in prices here. Today 12.75@12.85c., f.a.s., had been bid.

New York Lead Up to 7¼c.

The official contract price of the American Smelting & Refining Co. was advanced today from 7c. to 7.25c. per lb. New York. The pronounced strength of the lead market in the last forty-eight hours has been the cause for this advance. The outside market was above the old contract price before the advance occurred. In the first part of the week lead was obtainable in New York on a 7c. basis and in St. Louis for 6.75c. Beginning Monday a rush of inquiries occurred, which kept producers exceedingly busy making quotations and executing sales. With the single exception of one group of consumers—storage-battery manufacturers—all classes of buyers have been active purchasers of lead. It would seem that many consumers have delayed placing their orders, despite the small quantity of lead in their

stocks, and are now coming into the market with a rush. Although lead was booked today at 6.90c. per lb. in the Middle West, sellers are now asking 7c.

By far the largest amount of lead sold during the week was bought for 7c. in the East and 6.70c. to 6.85c. in St. Louis. Whereas producers were anxious to sell good-sized quantities earlier in the week, and did book a splendid volume of business, they are generally sitting tight and watching developments. The market has suddenly become a seller's.

Zinc Crosses 6c.

For the last two weeks most of the zinc business has been done by one producer, who has again sold a large tonnage, both domestic and for export. One or two good galvanizing orders have been placed, and brass special has been in demand at premiums of 2½ to 5 points over Prime Western grades. Supplies of prompt zinc in Europe seem to have been absorbed and dealers are forced to come to this country for the metal, which is shipped from Gulf ports. The domestic market is somewhat quieter today, with producers asking 6.05c., and bids of 6c. being made. High-grade continues at 7⅞@8¼c.

Tin Still Quiet as Price Goes Up

American consumers have continued merely interested observers of the speculative handling of the tin market in London. Prices have been boosted further, with no indication that the patience of the holders is near exhaustion waiting for American buying to begin. Spot and forward metal have sold at approximately the same prices. Arrivals of tin so far in July amount to 3,387 long tons.

Silver Holds Gains

After a slight decline the New York market has again advanced in sympathy with improved sterling exchange rates, prices here ruling consistently higher than the London parity.

Mexican Silver Dollars.— July 17, 51⅝c.; 18th, 51½c.; 19th, 51½c.; 21st, 51⅝c.; 22d, 51⅞c.; 23d, 51⅞c.

Foreign Exchange Also Higher

Sterling had a marked advance, and the Continental exchanges are slightly stronger. Closing cable quotations on Tuesday, July 22, were francs, 5.22c., and lire, 4.3425c. Canadian dollars, $\frac{33}{32}$ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28@29c. per lb.; 98 per cent, 26½@27c. London, £125 per long ton.

Antimony—Per lb.:
Chinese brands, 8.35@8.50c.
W. C. C. brand, 10½c.
Cookson's "C" grade, 11½@11¾c.
Chinese needle, lump, nominal, 8½@9c.

Bismuth—$2.40 per lb. London, 10s.

Cadmium—60c. per lb. London, 2s. 9d.

Cobalt—2.50@$3 per lb. for spot.

Iridium—$260@$270 per oz.

Iridium alloyed with platinum, $280 @$286.

Nickel—27c. per lb. for 99 per cent virgin metal. London, £135 long ton.

Osmiridium—Crude, $58.50 per oz.

Osmium—$95@$104 per oz.

Palladium—$78@$83 per oz. Crude, $60 per oz.

Platinum:
Refined, July 17, 18, and 19, $118; 21, 22, and 23, $120.
Crude, $114@$115.
Market firm at higher prices.

Quicksilver—$71.50 per 75-lb. flask. San Francisco wires $71.50; London, £13.

Rhodium—$85@$90 per oz.

Ruthenium—$40@$45 per oz.

The prices of **Germanium Oxide, Magnesium, Molybdenum, Monel Metal, Radium, Selenium, Tellurium, Thallium, Tungsten and Zirconium** are unchanged from the prices given in the July 5 issue.

Metallic Ores

Chrome — $19@$22, depending upon grade and source. Nominal.

Manganese—42@46c. per long ton unit, seaport, c.i.f. Nominal.

Molybdenum—80c. per lb. of MoS_2 for 85 per cent concentrates. Nominal.

Tungsten Ore—Per unit, N. Y.:
High-grade wolframite, $9@$9.25.
High-grade scheelite, $9.25.
Ordinary grades, $8.50@$8.75. Nominal.

Iron Ore, Magnetite, Tantalum, and **Vanadium** are unchanged from July 5 quotations.

Zinc and Lead Ore Markets Show Little Change

Joplin, Mo., July 19, 1924 — Zinc blende, per ton, high, $41.80; basis 60 per cent zinc, premium, $40@$41; Prime Western, $39.50 to $40; fines and slimes, $39@$37; average settling price, all blende, $38.30 per ton.

Lead, high, $81.80; basis, 80 per cent lead, $80; average settling price, all lead ore, $79.04 per ton.

Shipments for the week: Blende, 12,072; lead, 1,169 tons. Value, all ores the week, $555,790.

A large tonnage of zinc ore that may be classed as Prime Western seconds was sold the past three weeks on $40 basis. It is ore carrying an excess of iron content of more than 1 per cent, an allowance not deducted for, though each excess of 1 per cent iron is penalized $1 per ton for each unit of iron content. Though selling on a basis above first-quality Prime Western ores, the penalties place it on a lower price level.

Platteville, Wis., July 19, 1924.— Blende, basis 60 per cent zinc, $41.50@$42.75 per ton. Lead, basis 80 per cent lead, $85 per ton. Shipments for the week: Blende, 800 tons; lead, 120 tons. Shipments for the year: Blende, 16,169; lead, 652 tons. Shipments for the week to separating plants, 1,593 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli and **Zircon** are unchanged from July 5 prices.

Mineral Products

Arsenious Oxide (white arsenic)— 7¾c. per lb. Demand fair.

Copper Sulphate—4.50c. per lb. for domestic in carload lots. Imported at marked concessions.

Potassium Sulphate, Sodium Sulphate, Sodium Nitrate and **Zinc Oxide** are unchanged from July 5 prices.

Ferro-Alloys

Ferromanganese—Reduced to $105 per gross ton.

Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovanadium are unchanged from the prices given in the July 5 issue.

Metal Products

Copper—Sheets, 19½c. base; wire, 14½c.

Lead Sheets—Cut, 11c.; full, 10¾c. per lb.

Nickel Silver—18 per cent Grade A sheets, 25¾c.

Yellow Metal — Dimension sheets, 17½c.; rods, 14½c.

Zinc Sheets—Base price, $9.50 per 100 lb., f.o.b. plant.

Refractories

Firebrick — First quality, $40@$43 per M., Ohio, Kentucky, and Pennsylvania works; second quality, $33@$38.

Silica Brick—$36@$38 per M., Pennsylvania; $48, Alabama.

Bauxite Brick, Chrome Brick, Magnesite Brick, Magnesite Cement, and **Zirkite** are unchanged from July 5 prices.

Iron Trade Depending on Increased Industrial Activity

Pittsburgh, July 22, 1924.—No important change in the iron and steel trade has occurred in the last week, prices and rates of buying and production having been substantially the same since the beginning of July.

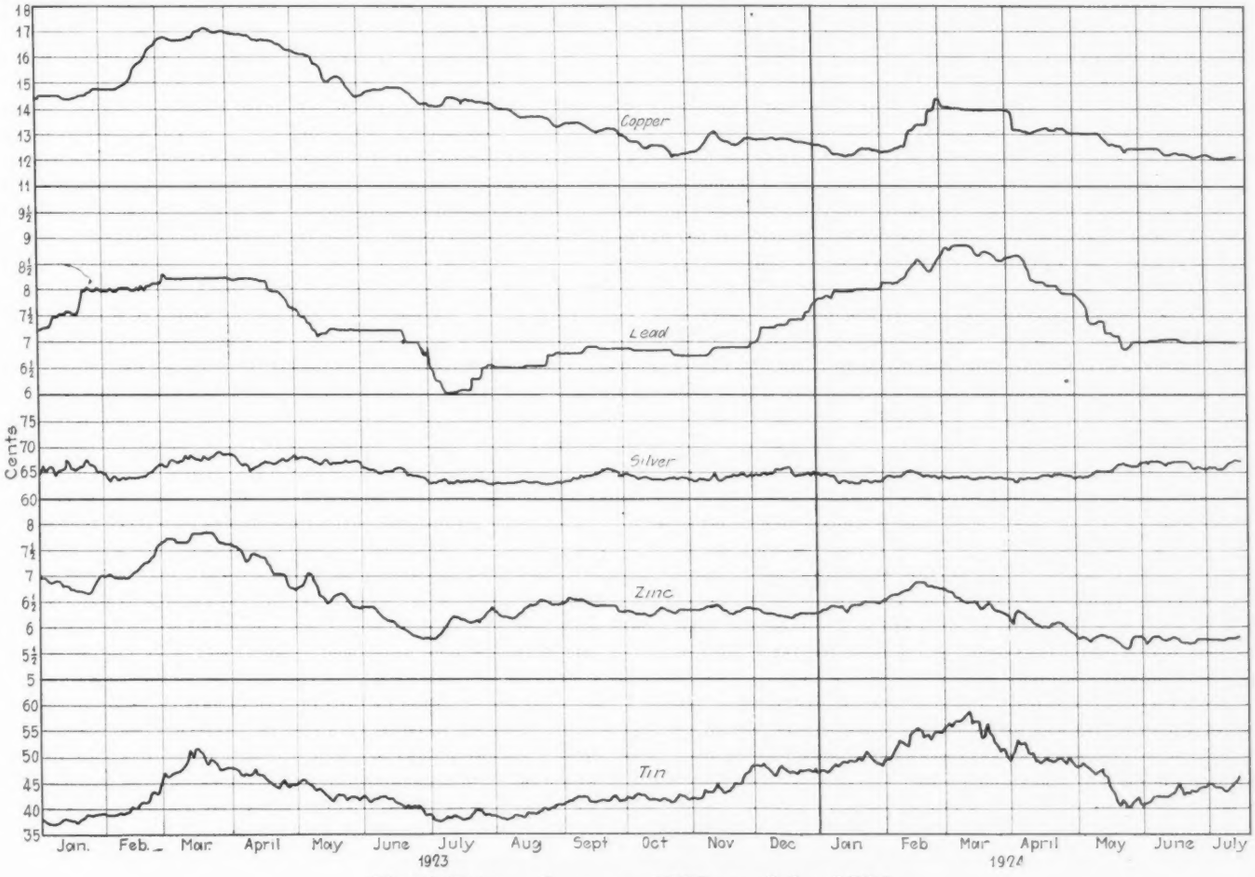
The steel industry is operating this month at fully 40 per cent, perhaps nearer 45 per cent, the operation being supported about two-thirds by current buying and one-third by old orders, chiefly for rails and freight-car material.

Pig Iron.—The market continues dull. Bessemer is off 50c. Bessemer, $20; basic, $19; foundry, $19, f.o.b. Valley furnaces.

Connellsville Coke.—The market is still very dull. Furnace, $3; foundry, $4.25@$4.75; heating, $2.60@$2.75.

Eighteen Months' Variation in Metal Prices

THE chart reproduced below shows the daily variation in the prices of copper, lead, zinc, tin, and silver from the first of January, 1923, to the middle of July, 1924. Two crests are apparent, one in March, 1923, and another in February-March, 1924. It would appear that all of the metals are likely to exhibit mild advances in prices in the near future, especially in view of the expected improvement in general business conditions, which the stock market is already discounting. Copper seems twice to have resisted a break through the 12c. level. Zinc, likewise, seems to have found about 5¾c. a level on which it could scrape bottom. Lead at 6c. last year was probably depressed more than was necessary; at any rate, the 7c. level decided upon by the leading producers this summer seems to have been better justified, for no great difficulty was experienced by producers in holding the price there, and now a somewhat stronger condition for the metal has become apparent.



Metal Prices, January, 1923, to July, 1924

Copper, cents per lb., f.o.b. refinery; lead, cents per lb., New York; silver, cents per oz.; zinc, cents per lb., St. Louis; tin, cents per lb. for spot Straits

Imports Decline—But Not Copper

A marked decline in imports of raw materials for use in manufacturing was the outstanding feature of American import trade for the first quarter of 1924, according to an analysis of the figures for that period just made public by the Foreign Commerce Department of the Chamber of Commerce of the United States. The analysis shows that textile imports, chiefly raw silk, wool, and cotton, alone accounted for $72,000,000 of the $80,000,000 decline below last year's figures.

It is pointed out in a statement by the department that although imports as a whole declined in value for the first three months of 1924 compared with the first quarter of 1923, some very striking gains were made by particular commodities, including crude petroleum, 30 per cent; refined petroleum products, 19 per cent; nitrate of soda, 40 per cent; copper ore, concentrates, and matte, 71 per cent; unrefined copper, 51 per cent; refined copper, 10 per cent; and tin in bars, blocks, and other forms, 12 per cent.

Comparison of the quantities of various commodities imported rather than the value brings out decided gains for lead ore and matte, 650 per cent; and manganese ores, 322 per cent. The most noticeable quantity declines include coal and coke, 83 per cent; pig iron, 78 per cent; and ferromanganese and other manganese alloys, 67 per cent.

Federated Metals Now a Corporate Entity

Benjamin Lissberger, president of the Federated Metals Corporation, announces that all matters pertaining to the consolidation and operation of the corporation have been completed, and that it will begin its corporate existence as of July 1, with an approximate capital of $15,000,000. The formation of the company was mentioned on page 895 of the *Mining Journal-Press* for May 31. Export and import offices have been established in Europe. The head offices will be in the Woolworth Building, in New York City, and the directors will include A. Grant, Z. Lippe and Stanhope Goddard in addition to those mentioned previously. Each of the companies concerned will continue to operate as heretofore, but in the future as branches of the parent company.

Markets for Nickel-Cobalt Ores

In an item recently appearing in the "Consultation" department of the *Mining Journal-Press*, an inquiry was made for the names of buyers of nickel-cobalt ores. Since this appeared, four firms have written in saying that they are in the market for material of this kind. We shall be glad to forward the names of these companies to any of our readers who have such ores for sale.

Company Reports

Silversmith Mines, Ltd.

Silver-Lead-Zinc; Sandon, B. C.

The board of directors of the Silversmith Mines, Ltd., on July 10 declared a $25,000 dividend, which amounts to 1c. a share, payable July 10 to shareholders of record at the close of business on July 1, 1924.

Operations during the period June 1, 1923, to May 31, 1924, inclusive, were satisfactory in the mine and mill. The mining operations were confined to the Slocan Star, Rabbit Paw, Heber Fraction, and Silversmith mineral claims, and the development work was done on the Slocan Star claim.

The average assay of mill feed was: Silver, 20.65 oz.; lead, 6.52 per cent; zinc, 7.25 per cent.

While operating during the fiscal year, 286 tons of crude lead, 4,546½ tons of silver-lead concentrates, and 2,738 tons of silver-zinc concentrates were produced. Shipments during the fiscal year amounted to 4,707 tons of silver-lead ore and concentrates, and 2,730 tons of silver-zinc concentrates.

During the fiscal year the average price received for silver by the company amounted to 64c. per oz. for 95 per cent of the silver contained in the ore. The average price received for lead was about 4.9c. a lb. for 90 per cent of the lead contents, this amount being what the company received from the smelter after deductions provided for in the schedule were taken into consideration. The metal contents of the ore shipped from the mine was as follows: 569,080.95 oz. silver, 3,786,782 lb. of lead, and 2,444,624 lb. of zinc. The accompanying statement shows a gain for the year of $162,349.03 before charging off $64,163.63 to "depletion reserve."

Balance Sheet, May 31, 1924

Assets

Cost of mining property	$330,466.10	
Less depletion	308,595.55	
		$21,870.55
Machinery and equipment	$183,684.78	
Buildings	87,042.42	
Total	$270,727.20	
Less depreciation	77,273.25	
		193,453.95
Total property		$215,324.50
Current assets		
Total cash in banks	$51,938.52	
Government bonds	65,000.00	
Ore in transit	36,721.14	
Ore on hand z	33,150.00	
Total current assets		186,809.66
Prepaid insurance		1,800.00
Total assets		$403,934.16

Liabilities

Capital stock		
Preferred		
Authorized	$250,000.00	
In treasury, unissued	250,000.00	
Common		
Authorized	$500,000.00	
Assessments not called	125,000.00	
Outstanding—paid up to 15c.		$375,000.00
Current liabilities		15,626.93
Surplus account (free)		13,307.23
Total liabilities		$403,934.16

Profit-and-Loss Account—Year Ended May 31, 1924

Total expenses		$332,510.01
Depletion of mine	$64,163.63	
Gain for the year	98,185.40	
		162,349.03
Total		$494,859.04
Received from sales, and ore on hand		$494,859.04

Surplus Account—May 31, 1924

Debit

Balance June 1, 1923		$85,601.88
Dominion government adjustments of depletion, 1922		4,519.95
Gain for year	$162,349.03	
Less depletion	64,163.63	
		98,185.40
Total		$188,307.23

Credit

Dividends paid	$175,000.00
Balance, May 31, 1924	13,307.23
Total	$188,307.23

Buena Tierra Mining Co., Ltd.

Silver-Lead; Chihuahua, Mexico

During 1923 the Buena Tierra Mining Co. shipped 6,396 short tons of ore, containing 11.4 oz. of silver and 15.8 per cent of lead per ton, to the smelter, and the net profits therefrom were sufficient to cover all actual costs of operation. In the early part of the year, however, £3,608 was spent on special diamond drilling, and to this must be added the cost of the other exploratory work, so that the result for the year is a loss of £4,593 19s. 7d., which, added to the previous debit balance of profit-and-loss account, brings this up to £63,913.

Though the grade of the ore was satisfactory, toward the end of the year the stopes failed to furnish a large supply of ore and the position of the company became unfavorable owing to declining production. Since the close of the year further deposits of ore of even better grade have been discovered, with the effect that the shipments are increasing and the outlook for the future is therefore improving.

In 1923 the company completed the drilling campaign initiated in 1922, but with negative results. A moderate amount of other development work was also done. The physical condition of the mine is excellent, and all plant and equipment are in good operating condition. A material improvement underground is noticeable.

A continuance of the prevailing splendid price of lead would prove a great help to the company, and if accompanied by a reasonable output of ore, should enable it to resume highly essential development and exploration. Small pockets of ore now being mined are too erratic to make definite expression of opinion regarding the future desirable, says the report.

Mining Dividends Decrease Somewhat in July

The following dividends were paid by mining and metallurgical companies in July:

Companies in the United States	Situation	Per Share	Total
Arizona Commercial, c	Ariz.	$0.50 SA	$132,500
Bethlehem Steel	Various	1.25 QB	845,106
Cresson Consolidated Gold	Colo.	0.10 Q	122,000
Eagle-Picher Lead pfd	Various	1.50 Q	15,000
Homestake Mining, g	S. D.	0.50 M	125,580
Inland Steel pfd	Minn.	1.75 Q	175,000
Kennecott Copper	Alaska	0.75 Q	2,090,341
Park City, s. l. z	Utah	0.15 Q	131,400
Phelps Dodge, c	Various	1.00 Q	500,000
Republic Iron & Steel pfd	Various	1.75 Q	437,500
Silver King Coalition, s. l.	Utah	0.15 Q	182,415
Sloss-Sheffield Steel & Iron pfd	Ala.	1.75 Q	117,250
Tintic Standard, s. l. c	Utah	0.25 QX	287,185
Tonopah Extension, s. g	Nev.	0.05 Q	69,636
United Eastern, g	Ariz.	0.05 Q	68,150
U. S. Smelting, Ref. & Mng. pfd., s. l.	Various	0.875 Q	425,556
Virginia Iron, Coal & Coke, pfd	Various	2.50 SA	250,000
Companies in other countries			
Ahumada Lead	Chihuahua	0.15 Q	178,053
Asbestos Corporation pfd	Quebec	1.50 Q	60,000
Consolidated Mining & Smg., s. l. z. c.	B. C.	0.75 SA	316,011
Dome Mines, g	Ont.	0.50 Q	238,333
Erupcion, l	Chihuahua	0.15 Q	187,500
Hollinger Consolidated Gold	Ont.	0.05 4 wks.	246,000
N. Y. & Honduras Rosario, g. s.	Honduras	0.25 Q	50,000
Nipissing, s	Ont.	0.15 Q	180,000
Premier Gold	B. C.	0.08 Q	400,000
Silversmith, s. l. z	B. C.	0.01 Q	25,000
Wright-Hargreaves, g	Ont.	0.025 Q	68,750
Total			$7,924,266

C, copper; g, gold; l, lead; z, zinc; s, silver; SA, semi-annually; Q, quarterly; M, monthly; B, also paid $1.75 on 7 per cent preferred and $2 on 8 per cent preferred; X, includes 15c. extra.

The total of dividends paid during July was about $3,600,000 less than that paid for the corresponding previous quarter, in April. The principal reason for the decrease was the fact that no dividend was paid by the Great Northern Iron Ore Properties, which amounted to $3,000,000 in April. As this dividend is paid irregularly, however, its absence this month is unimportant. Park Utah passed its usual dividend, and Howe Sound did not report its usual dividend of 5c. a share. Silver King Coalition paid only 15c. compared with 30c. in April, and Nipissing made the same reduction. United Eastern paid 5c. instead of 10c., the company having closed down owing to exhaustion of ore reserves after a prosperous career during which $5,997,200 in dividends has been paid on a capitalization of $1,363,000. Consolidated Mining & Smelting paid only 75c. instead of $1.50 as in January. On the other hand, a bright spot exists in Utah, where the Tintic Standard raised its dividend from 15c. to 25c.

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Slight advances occurred during the month in such materials as track supplies, lime, linseed oil and manilla rope. These increases are purely local price adjustments at dealers' warehouses and do not indicate any serious break in the general downward price trend of mine materials and supplies. Declines are reported in the following: steel structurals and sheets, c.-i. pipe, nuts, nails, pine and fir timbers.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.75@2.80	$4.10	$3.90	$5.00	$3.89
Black					
No. 28	3.65	5.00	4.70	5.80	4.60
Galvanized					
No. 28	4.60@4.80	6.00	5.60	6.50	5.60

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh			
	Current	One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh				San Francisco	Birmingham
	Current	One Year Ago	Chicago	St. Louis		
Standard spikes, ⅝-in. and larger	$2.90@3.00	$3.15	$3.00	$3.75–3.85	$4.85	$3.72
Track bolts	3.75@4.25	4.00@4.25	4.00	3.65–3.90	5.85	4.57
Standard section angle bars	2.75	2.75	2.75	3.45	4.00	3.20

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.95@2.15	$3.00	$3.34	$4.20	$3.45	$3.10	$3.60
Channel, 3 to 15 in.	1.95@2.15	3.00	3.34	4.20	3.45	3.10	3.60
Angles, 3 to 6 in., ¼ in. thick	1.95@2.15	3.00	3.34	4.20	3.45	3.10	3.60
Tees, 3 in. and larger	1.95@2.15	2.90	3.34	4.20	3.50	3.10	3.60
Plates	1.80@2.15	3.00	3.34	4.20	3.45	3.10	3.60

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	60%	40@55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Steel Black		Iron Black	
Inches	Galv.	Inches		Galv.
BUTT WELD—1 to 3	62	50½	1 to 1¼	30	13
LAP WELD—2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
2½ to 6 in. lap welded	44%	47%	46%

CAST IRON PIPE—The following are prices per net ton for carload lots:

	New York					San Francisco
	Current	One Year Ago	Birmingham	Chicago	St. Louis	
6 in. and over	$60.60@61.60	$62.30	$49.00	$56.20	$52.60	$59.00

Nuts—	New York	Cleveland	Chicago
Hot pressed, sq., per 100 lb. Off list	$1.50	$4.00	$4.00
Cold punched, sq., per 100 lb. Off list	1.50	4.00	4.00

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York						
	Current on Trucks	One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1162	$0.1573	$0.064	$0.125	$0.078	$0.108	
6x12x12	.1743	.2097	.088	.....	.106	.156	$0.2786*
8x12x12	.2179	.2621	.12	.215	.14	.244	.3448†

* 10x12x12; † 12x12x12.

MACHINE BOLTS—	New York	Cleveland	Chicago
All sizes up to 1x30-in.	50%	60–10–5%	60%

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers in yards at San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$35.00	$36.00	$37.00	$40.00
3x6 and 8	35.00	36.00	37.00	40.00
4x4-6 and 8	35.00	36.00	37.00	40.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$42.00	$43.00	$41.50	$43.50
3x10 to 10x10	46.00	47.00	46.50	48.50
3x12 to 12x12	52.00	53.00	51.50	53.50

Other Cities	8 x 8-In. x 20 Ft. and Under				12 x 12-In. 20 Ft. and Under	
	Pine	Fir*	Hemlock	Spruce	Pine	Fir*
Boston	$57.00	$60.00†	$50.00	$50.00	$65.00	$75.00†
Cincinnati	40.00	74.00	74.00	88.00	44.00	78.00
Denver	.....	35.75	36.75	36.75	.....	36.75
Minneapolis	40.00	38.75	39.00	.....	43.10	39.75
Kansas City	43.50	48.50	.....	.....	54.50	49.50
Birmingham	24@30	.....	.....	.....	25@31	.....

* Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.90	$3.80	$4.10	$4.55	$3.24	$4.95
Cut	3.00	4.45	5.25	5.75	3.49	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.50@2.60	$2.50@2.60	$2.70@2.80
Chicago, f.o.b.	2.20	2.20	2.20
Cleveland, f.o.b.	2.39	2.39	2.46

LIME—Warehouse prices:

	Hydrated, per Ton		Lump, per Barrel	280-lb. net
	Finishing	Common	Finishing	Common
New York	$18.20	$13.10	$3.75	$3.00@$3.25
San Francisco	22.60	22.60	.....	(180-lb net) 2.15

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	One Year Ago	Current	One Year Ago
Raw in barrel (5 bbl. lots)	$1.03	$1.13	$1.05	$1.28

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry		In Oil	
	Current	1 Yr. Ago	Current	1 Yr. Ago
Red	14.50	14.50	16.00	16.00
White	14.50	14.50	14.50	14.50

HOSE—Quotations at New York warehouses:

Fire Protection — 50-Ft. Lengths

Underwriters' 2½-in. coupled, single jacket ..... 56c per ft.

Air—Best Grade

¾-in., per ft. ..... 3 ply $0.36 4 ply $0.44½

Steam—Discounts from List

First grade ..... 30–5% Second grade ..... 40–5% Third grade ... 50%

RUBBER BELTING—The following discounts from list apply to rubber transmission belting:

Best grade ..... 50% Second grade 50–10%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	40–2½%
Heavy	30–5%

RAWHIDE LACING—For cut, best grade, 45–5%, 2nd grade, 55%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 45–5%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ⅛ in.	$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.22½	New Orleans	$0.17½
New York	.19½	Seattle	.18
Chicago	.18	San Francisco	.17

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin	
	40%	60%
New York	$0.27	$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.2125	.2325
New Orleans	.235	.29
San Francisco	.1625	.1925

FLOTATION OILS—All prices are per gal. in carload lots; 50-gal. bbls., gross weight 500 lbs.

Pine oil, steam dist., f.o.b. New York	$0.60
Pine tar oil, f.o.b. New York	.30

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	$0.09½
Litharge, f.o.b. New York, kegs, per 100 lb.	14.50
Sodium cyanide, 220 lb. single case lots, f.o.b. New York, per lb.	.19@.22

Mining Stocks

Week Ended July 19, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb	...	...	*10	...	...
Anaconda	New York	32⅜	29⅞	32¼	De.15, Ja.21, Q	0.75
Arcadian Consol.	Boston	1¼	1⅛	...	...	...
Ariz. Com'l.	Boston	10½	8⅝	10⅜	Jy.19, Jy.31	0.50
Calaveras	N. Y. Curb	...	...	1⅛	...	...
Calumet & Arizona	Boston	46¾	44	46¼	Jn. 6, Ju. 23 Q	0.50
Cal. & Hecla (New)	Boston	17	14⅜	17	My. 31, Jn. 16	0.50
Canario Copper	N. Y. Curb	3¼	3	3¼	...	...
Cerro de Pasco	New York	47⅞	44½	47	Ju. 17, Au. 1	1.00
Chile Copper	New York	29½	28⅜	29½	Jn.2, Jn.30, Q	0.62½
Chino	New York	19½	17⅞	19½	Sept., 1920,	0.37½
Con. Coppermines	N. Y. Curb	2 5/16	2⅛	2 5/16	...	...
Copper Range	Boston	25¼	21⅛	25	May, 1923	1.00
Crystal Copper	Boston Curb	*64	*58	*64	...	...
Davis-Daly	Boston	*50	*50	*50	Mar., 1920	0.25
East Butte	Boston	4	3¼	4	Dec., 1919	0.50
First National	Boston Curb	*32	*30	*30	Feb., 1919,	0.15
Franklin	Boston	*60	*50	*60	...	...
Gadsden Copper	Boston Curb	*70	*65	*70	...	...
Granby Consol.	New York	16¼	13⅝	16¼	May, 1919	1.25
Greene-Cananea	New York	13⅜	11¼	13⅜	Nov., 1920	0.50
Hancock	Boston	1½	1	1⅛	...	...
Howe Sound	N. Y. Curb	...	...	2	Ap.1, Ap.15, Q	0.05
Inspiration Consol.	New York	24¾	22⅛	24⅜	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	*3	*2⅝	*3	May, 1923	0.15
Isle Royale	Boston	16¼	12⅜	16⅛	Se. 1, Se. 15,	0.50
Jerome Verde Dev.	N. Y. Curb	*85	*76	*85	...	...
Jib Consol.	N. Y. Curb	*90	*71	*74	...	...
Kennecott	New York	41⅞	39⅞	41⅞	Jn.6, Jy. 1, Q	0.75
Keweenaw	Boston	†*60	...	...	...	...
Lake Copper	Boston	†1¼	...	...	...	...
Magma Copper	New York	29¼	27½	29⅜	Jan., 1919	0.50
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛	...	...
Mass Consolidated	Boston	†*70	...	...	Nov., 1917	1.00
Miami Copper	New York	22⅛	20⅝	22⅛	Au.1, Au.15, Q	0.50
Mohawk	Boston	30	26	30	Se. 22, Oc. 13,	1.00
Mother Lode Coa.	New York	7⅛	6¾	7⅛	Jn.13, Jn.30	0.37½
Nevada Consol.	New York	13½	13	13⅛	Sept., 1920,	0.25
New Cornelia	Boston	19⅛	17⅞	19	My.9, My.26,	0.25
New Dominion	N. Y. Curb	...	...	2⅛	...	...
North Butte	Boston	4⅛	3¼	4⅛	Oct., 1918,	0.25
Ohio Copper	N. Y. Curb	1 1/16	*98	1 1/16	...	...
Old Dominion	Boston	23¼	16½	23	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†105	†99	...	Jn.21, Jy.2 Q	1.00
Quincy	Boston	22	16	22	Mar., 1920	1.00
Ray Consolidated	New York	11	10⅜	11⅛	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	...	...	*10	...	...
St. Mary's Min. Ld.	Boston	35	28	35	Ap.22, My.20	3.00
Seneca Copper	New York	⅞	⅞	⅞	...	...
Shannon	Boston	*70	*50	*70	Nov., 1917	0.25
Shattuck Arizona	New York	6¼	5	6¼	Jan., 1920	0.25
Superior & Boston	Boston	*75	*50	*75	...	...
Tenn. C. & C. cfs.	New York	7⅛	7	7⅛	De.31, Ja.15, Q	0.25
United Verde Ex.	N. Y. Curb	24⅛	22⅞	24⅛	Jy.3, Au.1	0.50
Utah Copper	New York	73⅝	70	73	Jn.13, Jn.30,	1.00
Utah Metal & T.	Boston	*30	*23	*27	Dec., 1917	0.30
Victoria	Boston	*75	*60	*75	...	...
Walker Mining	N. Y. Curb	...	...	3	...	...
Winona	Boston	*40	*25	*40	...	...
NICKEL-COPPER						
Internat. Nickel	New York	18⅛	16⅝	18⅛	Mar., 1919	0.50
Internat. Nickel pfd.	New York	87⅛	86⅝	87⅛	Jy.17, Au.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	2⅜	2⅛	2⅛	...	...
National Lead	New York	147¼	142	146	Jn.13, Jn.30, Q	2.00
National Lead pfd.	New York	114	113½	114	My. 23, Ju. 14, Q	1.75
St. Joseph Lead	New York	29	27⅛	28⅜	Se. 9, Se.20	0.50
ZINC						
Am. Z. L. & S.	New York	9	7⅜	7⅛	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	28½	25½	28½	Nov., 1920	1.50
Butte C. & Z.	New York	5⅛	4⅛	5	Mar., 1923	0.50
Butte & Superior	New York	17	14⅛	17	Je.15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	3½	2⅜	3⅜	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	144	144	144	May 10, 1924	2.00
United Zinc	N. Y. Curb	...	...	*25	...	...
Yellow Pine	Los Angeles	63¼	62½	62½	June, 1924	0.04
SILVER						
Alvarado	N. Y. Curb	1	1	1	...	...
Beaver Consol.	Toronto	†*16	†*15	*14½	May, 1920	0.03
Castle-Trethewey	Toronto	*72	*67½	*71½	...	...
Coniagas	Toronto	1.40	1.40	1.40	Ap.20, My.1	0.02½
Crown Reserve	Toronto	*55	*54	*55	Jan., 1917	0.05
Keeley	Toronto	2.23	2.21	2.22	...	...
Kerr Lake	N. Y. Curb	1⅛	1⅛	1⅛	Ap.1, Ap.15, Q	0.12
La Rose	Toronto	*16	*10	*16	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.40	1.37	1.38	...	...
McKinley-Dar.-Sav.	Toronto	*11	*10½	*10½	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.47	2.45	2.45	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6⅛	6	6	Jn.30, Jy.21, Q	0.15
Ontario Silver	New York	6⅛	5	6⅛	Jan., 1919	0.50
Temiskaming	Toronto	21	19	20	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	⅜	⅜	⅜	...	...
Alaska Juneau	New York	1⅛	1⅛	1⅛	...	...
Argonaut	Toronto	*41	*39	*40	...	...
Carson Hill	Boston	1	1	1	...	...
Cresson Consol. G	N. Y. Curb	4 1/16	3½	3⅝	Jn.30, Jy.10, Q	0.10
Dome Mines	New York	16½	15⅝	16	Jn.26, Jy.21, Q	0.50
Golden Cycle	Colo. Springs	†1.33	†1.28	...	My.31, Jn.10 Q	0.03
Hollinger Consol.	Toronto	14.20	13.97	14.15	Jy.24, Au.11, M	0.05
Homestake Mining	New York	43½	43	43½	Jn.20, Jy.25,	0.50
Kirkland Lake	Toronto	*19½	*18	*19⅜	...	...
Lake Shore	Toronto	3.80	3.75	3.76	My.2, My.15	0.02
McIntyre-Porcupine	New York	16	15½	15½	Au. 1, Se. 1,	0.25
Newray	Toronto	*23	*20	*22½	...	...
Portland	Colo. Springs	†57	†53	...	Oct., 1920	0.01
Teck-Hughes	Toronto	1.15	1.14	1.14	...	...
Tom Reed	Los Angeles	32½	30	32	Dec., 1919	0.02
Tough-Oakes	Toronto	*58	*55	*55½	...	...
United Eastern	N. Y. Curb	*47	*47	*47	Jy.18, Jy.31, Q	0.05
Vipond Cons.	Toronto	1.03	*99	1.02	...	...
Wright-Hargreaves	Toronto	3.50	3.45	3.45	Jn.16, Jy.1, Q	0.02½
GOLD AND SILVER						
Black Oak	N. Y. Curb	*86	*84	*86	...	...
Con. Cortez	N. Y. Curb	*15	*14	*15	...	...
Con. Virginia	San Francisco	3½	2½	2½	...	...
Continental Mines	N. Y. Curb	1⅛	1	1	...	...
Dolores Esperanza	N. Y. Curb	...	...	*50	Jy. 1, Jy. 10 Q	0.05
Premier Gold	N. Y. Curb	1⅛	1⅛	1⅛	Jn.19, Jy.2	0.08
Tonopah Belmont	N. Y. Curb	*52	*52	*52	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb	*24	*23	*23	Se.22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	2 5/16	2⅛	2⅛	Jn. 10, Jy. 1	0.05
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1⅛	Ap. 6, Ap. 21	0.07½
Unity Gold	N. Y. Curb	1	*80	*80	...	...
West End Consol.	N. Y. Curb	...	...	*31	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	...	...	*50	June, 1918	0.02
SILVER-LEAD						
Ahumada	Boston Curb	5⅛	5⅛	5⅛	Jn.16, Jy. 2, X	0.15
Bingham Mines	Boston	†16½	...	...	Sept, 1919	0.25
Cardiff M. & M.	Salt Lake	...	...	*74	Dec., 1920	0.15
Chief Consol.	Boston Curb	3	2½	3	Ap 19, My.1, Q	0.10
Columbus Rexall	Salt Lake	16	15	15	Aug., 1922	0.03
Consol. M. & S.	Montreal	39⅛	38½	39½	Jn.30, Jy.15	0.75
Daly Mining	Salt Lake	2.00	2.00	2.00	July, 1920	0.10
Erupcion	Boston Curb	2⅜	2⅜	2⅜	Jn 16, Jy.2, X	0.15
Federal M. & S.	New York	10¼	10⅛	10⅛	Jan., 1909	1.50
Federal M. & S. pfd.	New York	48¼	44½	47¼	My.26, Jn.15, Q	1.75
Florence Silver	Spokane	9	8⅞	9	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	9	8¾	8¾	My.15, Jn.15,	0.25
Iron Blossom Con.	N. Y. Curb	...	...	*20	Oct., 1923	0.02
Marsh Mines	N. Y. Curb	*5	*5	*5	June, 1921	0.02½
Park City	Salt Lake	3.90	3.80	3.25	Jn.14, Jy.1,	0.15
Park Utah	N. Y. Curb	...	...	3⅛	Mc.15, Ap.1	0.15
Prince Consol.	Salt Lake	*5½	*5½	*5½	Nov., 1917	0.02
Silver King	N. Y. Curb	...	...	*50	Jn.20, Jy.1, Q	0.15
Silversmith	Spokane	*32½	*31	*31	Jy.1, Jy. 10,	0.01
Tamarack-Custer	Spokane	1.45	1.40	1.40	Jn 25, Jn.30,	0.02
Tintic Standard	Salt Lake	4.75	4.50	4.70	Jy.28, '24, X	0.25
Utah-Apex	Boston	2⅛	2	2⅛	June, 1923,	0.50
IRON						
Bethlehem Steel	New York	46¾	41⅛	42⅜	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	...	...	⅞	...	...
Char. Iron pfd.	Detroit	...	...	1¼	...	...
Colorado Fuel & Iron	New York	48¼	44¾	45⅛	My.10, My.26	Q 2.00
Col. Fuel & Iron pfd.	New York	...	...	102	Feb., 1923	2.00
Gt. North'n Iron Ore	New York	29¾	22⅛	29⅛	De.10, De.27	2.00
Inland Steel	N. Y. Curb	...	...	46	My.15, Jn.1 Q	0.62½
Mesabi Iron	N. Y. Curb	...	...	2⅞	...	...
Replogle Steel	New York	13½	11	13¼	...	...
Republic I. & S.	New York	47⅜	44¼	46½	May, 1921	1.50
Republic I. & S. pfd.	New York	87	86	86½	Se.15, Oc.1, Q	1.75
Sloss-Sheffield S.&I.	New York	59	57½	57⅞	Jn.6, Jn.20, Q	1.50
Sloss-Shef. S.&I.pfd.	New York	82½	82½	82½	Jn.18, Jy.2, Q	1.75
U. S. Steel	New York	101½	99¼	100	Jn 1, Jn.28 QX	1.75
U. S. Steel pfd.	New York	122¼	121¼	121⅞	My.6, My.29, Q	1.75
Virginia I. C. & C.	New York	...	...	36½	De.15, Ja. 2	1.50
Virginia I.C.&C.pfd.	New York	...	...	71	Jn.17, Jy.1	2.50
VANADIUM						
Vanadium Corp.	New York	23	21⅛	21⅜	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	*23	*20	*20	...	...
ASBESTOS						
Asbestos Corp.	Montreal	24¾	24¼	24¾	Se.29, Oc.15 Q	1.00
Asbestos Corp. pfd.	Montreal	...	...	60	Jy.1, Jy.16, Q	1.50
SULPHUR						
Freeport Texas	New York	9⅝	8¾	9⅝	Nov., 1919,	1.00
Texas Gulf	New York	72	67½	71½	My.31, Jn.14 QX	1.75
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3¼	3⅛	3⅛	...	...
MINING, SMELTING AND REFINING						
Amer. Metal	New York	43¼	40⅞	43¼	My.20, Jn.1, Q	0.75
Amer. Metal pfd.	New York	...	...	112	My.20, Jn.1, Q	1.75
Amer. Sm. & Ref.	New York	68⅜	64½	68⅜	Jy.11, Au.1, Q	1.25
Amer.Sm.&Ref.pfd.	New York	102⅜	102	102⅜	Au. 8, Se. 1,	1.75
U. S. Sm. R. & M.	New York	28	22⅜	28	Jan., 1921,	0.50
U.S. Sm. R.&M.pfd.	New York	45⅜	41	45⅛	Jy.7, Jy.15 Q	0.87½

* Cents per share † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Colorado Springs, Colorado Springs Stock Exchange.